Communication in Problem Based Learning

by

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Abstract

Problem Based Learning (PBL) is one of the many ways that undergraduates are supported to learn in Norwich Medical School. PBL is an instructional design model that was first introduced into medical schools in Canada in the 1960s. Theoretical arguments were put forward in the medical education literature that claimed PBL was a revolutionary, new and superior learning method. The method attracted considerable enthusiasm, but it also attracted controversy. Descriptions of the process were diverse and the pedagogy was illusive. Never the less, it subsequently spread worldwide, and thousands of medical students now learn in PBL groups.

The purpose of my research was to explore PBL at Norwich medical school and to find ways to improve it. My focus was on communication in PBL tutorials, and the aim was to identify communicative elements that realised and hindered effective dialogue.

The objectives were to

1) Consider the theoretical framework of PBL and explore enablers and barriers to effective dialogue,
2) Consider the learning environment of the PBL tutorial, particularly brainstorming, and identify ways in which to maximise the learning opportunities,

3) Determine how this knowledge can be used to facilitate effective dialogue to take place between learners in PBL.

The main research question was;

What communicative strategies can be used by tutors to enhance elaborative dialogue to take place in brainstorming in Problem Based Learning tutorials?

Using elements of Conversation Analysis (CA), I explored communication in PBL. Focusing particularly on brainstorming, I identified specific communicative elements that were used by tutors to facilitate elaborative dialogue. Elaborative dialogue, in which students explain their thinking, appears to be of particular importance in the learning and understanding of concepts. Elaboration includes;

a) Verbalising conceptual understanding,
b) Identifying conflicting information,
c) Co-construction of understanding,
d) Answering/ asking relevant questions,

It is clear that the extent to which students benefit from working in small groups depends on the quality of interaction between students within the group. I identified communicative elements that were inhibitory to elaborative dialogue. In addition, I identified that there were contextual factors that inhibited

communication between students in the tutorials for example, students were expected to chair tutorials, but they struggled to perform the role.

The findings from my study are useful for PBL tutors who can use these elements of conversation analysis to examine their own practices; for example, tutors can audio record a section of a PBL tutorial, and identify their own questioning techniques that have promoted useful dialogue between learners, and reflect on their practice. This conversation analysis method can be applied to other small group teaching methods in other disciplines and by other organisations. I hope this will serve as a starting point to encourage individual tutors and institutions to explore ways to enhance communication in PBL tutorial groups and enrich the learning experiences for students.

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Contents

Glossary

Ace inhibitors	a class of drug used in the treatment of blood pressure
Arrhythmia	medical term for a group of conditions in which the heart beat is irregular
Brainstorming	a discussion process used as a starting point in PBL tutorials
Cardiovascular	the body system involving the heart
Calcium channel blockers	a class of drug used in the treatment of blood pressure
Chair	student member of a PBL group who is responsible for leading the tutorial
Clinical reasoning	a process of collecting information to come up with list of possible diagnoses
Clinical skills	ability to perform the practical duties of a doctor including taking a history, examining patients, organising and interpreting tests, making a management plan, prescribing, undertaking practical procedures and communication with patients and relatives
Coagulation cascade	a process that occurs to make the blood clot
Communication skills	ability to communicate effectively with patients, relatives and carers to take account of patients' ideas, concerns and expectations.

Conversation analysis	an approach to the study of dialogue in social interaction
Diabetes	a disorder in which the body is unable to metabolise sugar
Diagnosis	identification of a disease
Differential diagnosis	a list of possible causes for a patient's symptoms and signs
Double blind	see randomised control trial
Duodenal ulcer	an open sore on the lining of the bowel wall
D-dimer	a blood test to help in the diagnosis of thrombosis. A negative test practically rules out the diagnosis
Elaborative dialogue	discussion between students which contains verbalisation of conceptual understanding and co-construction of meaning including asking and answering questions
Elective	a period of study abroad to experience health care in a different environment
Electroencephalogram	a test of electrical activity of the brain
Empathy	ability to understand the feelings of others
Evaluation	appraising effectiveness of practice
Evidence based medicine	application of scientific evidence to medical practice.
Facilitator	a tutor who enables a group to perform a specific function

Functional magnetic resonance imaging	a test of brain activity by measuring blood flow
General Medical Council	a body which oversees the standard of the medical profession
Hypertension	High blood pressure
Hypertrophic Obstructive Cardiomyopathy	A condition in which a portion of the heart muscle becomes thickened
King's Fund	an English health charity that shapes health and social care policy and practice, provides NHS leadership and hosts healthcare events
Learning objectives	a list of faculty derived learning outcomes against which the students will be assessed
Mean corpuscular volume	the average volume of red blood cells
National Institute for Health and Care Excellence.	an executive non-departmental public body of the Department of Health
Non-Steroidal Anti-inflammatory	a class of drug /pain killer

Objective Structured Clinical Examination	an exam in which students move round a timed circuit performing tasks which are observed and assessed by an examiner
Osmosis	a process by which molecules pass from a less concentrated solution to a more concentrated solution through a semipermeable membrane
Pharmacology	the study of drugs
Physiology	the study of the functional mechanisms of the body
Placement	a learning environment away from the medical school, typically a hospital or general practice
Pneumonia	an infection in the lungs
Professionalism	the ability of students and doctors to comply with the expectations of the GMC and general public
Randomised controlled trial	a study in which a number of similar people are assigned to two groups to test a specific intervention. One group receives the intervention the other group is the control. In a double blind randomised control trial neither the participants nor the investigators know to which group participants have been assigned.
Rote learning	memorisation of facts

Reflective practice	ability to consider one's own performance in an objective manner
Scenario	a patients' case or a problem presented to the group at the start of brainstorming
Scribe	a student member of a PBL group who is responsible for documentation.
Strategic learner	a student who can apply different learning methods to achieve outcomes efficiently
Stool	faeces
Student centred	a course designed to meet the needs of the students
Student selected studies	part of the undergraduate curriculum for which study options are available
Thrombosis	a blood clot
Warfarin	a drug used to thin blood

Abbreviations

BMA	British Medical Association: the professional association and registered trade union for doctors in the United Kingdom.
BMJ	British Medical Journal: a provider of journals, clinical decision support, events and medical education. It is a wholly owned subsidiary of the British Medical Association.
CA	Conversation analysis
CURB	Calculation to assess the severity of pneumonia
EEG	Electroencephalogram
FY1	Foundation Year 1 doctor. First post after qualification
FY2	Foundation Year 2 doctor. Second year after qualification
fMRI	Functional magnetic resonance imaging
GMC	General Medical Council
HOCM	Hypertrophic obstructive cardiomyopathy
IRE	Initiation, response, evaluation
MCV	Mean corpuscular volume
MI	Myocardial Infarction
NICE	National Institute for Health and Care Excellence
PBL	Problem Based Learning

UEA	University of East Anglia

CHAPTER 1 Introduction

Statement of the problem

In 2009 I became a PBL tutor at Norwich Medical School. I tutored several groups over the next few years and gradually began to realise there was a dichotomy between what I observed happening in practice and the PBL process described in the literature. This was particularly noticeable in the brainstorming part of the tutorial. I felt that the students spent a lot of time discussing organisational issues and seemed to spend very little time discussing medical knowledge. I had expected to hear students discussing their understanding of medical concepts and coming up with objectives they had identified as a learning need. What I heard were superficial discussions that I felt were not an efficient use of their time together as a group. I felt more detailed discussions of medical concepts would be of better educational value. Through conversations with other tutors, I found many that felt the brainstorming part of their tutorial was difficult and not always useful (Appendix 1). There was lack of clarity about the purpose of brainstorming. There was also hesitancy to make changes, and concern that criticism of the effectiveness of brainstorming in PBL was not permissible. This sparked my interest to investigate the factors that inhibited effective dialogue in PBL brainstorming and to find ways in which it could be made a more efficient learning tool at Norwich Medical School.

Research question

What communicative strategies can be used by tutors to enhance elaborative dialogue to take place in brainstorming in Problem Based Learning tutorials at Norwich Medical School?

Aims and objectives

The purpose of my research was to find ways to improve PBL tutorials at Norwich Medical School. My focus was on communication in PBL tutorials and the aim was to identify communicative elements that realised and hindered effective dialogue, specifically in brainstorming, in order to maximise the learning opportunities for students.

The objectives were to

1) Consider the theoretical framework of PBL and explore enablers and barriers to effective dialogue,
2) Consider the learning environment of the PBL tutorial, focusing particularly on brainstorming, and identify ways in which to maximise the learning opportunities,
3) Determine how this knowledge can be used to facilitate effective dialogue to take place between learners in PBL.

My thesis explores dialogue in brainstorming in PBL tutorials for Year 2 students at Norwich Medical School. Using elements of conversation analysis, I examined the dialogue that took place in brainstorming, and explored linguistic elements that could be facilitatory and inhibitory in promoting effective dialogue between

learners. I considered the theoretical framework of PBL and reflected on the extent to which the theoretical underpinnings were relevant to the design and implementation of PBL in Norwich Medical School. I also explored contextual barriers that the dialogue revealed were preventative to elaborative dialogue.
I considered ways in which tutors and course designers could use this knowledge in order to help PBL tutors to enable effective dialogue to take place, to maximise the learning opportunities in the PBL classroom.

Importance of the research

PBL is a widespread educational method and thousands of medical students learn in PBL groups worldwide. It is vital for medical students to be trained well in order to be able to carry out the important and essential work of doctors to standards that are expected. The undergraduate curriculum must be rigorous to meet the learning needs of students in order to enable them to demonstrate they have met required competencies. In the current climate in the UK in which the government is putting pressure on Universities to improve teaching standards (Johnson 2016) and students are more vocal than ever about their rights to receive high quality teaching (Meadows 2018), research in this area is timely and valuable.
My research adds to the field of medical education and medical education research literature in four general areas. First, the research methods I have used add to the repertoire of approaches that can be used to investigate practice. Secondly, my research findings provide practical guidance for tutors to enable them to use strategies to facilitate effective dialogue between learners. Thirdly, my data reveals

contextual challenges that can impact the pedagogical processes in PBL. Fourthly, the thesis offers an insight into why previous research has produced variable conclusions about the effectiveness of PBL.

What is PBL?

PBL is a student centred pedagogy in which small groups of students are facilitated to learn through discussion of a case. PBL encompasses a wide variety of practice in medicine. As a broad outline it comprises; 1) learning in small groups, 2) teacher-facilitated learning, 3) learning by means of self-study and 4) learning by means of problems that are first discussed in the group (Dolmans and Gijbels 2013). This is the framework that I use as a definition of PBL for this thesis. Learning in small groups and self-study are found in many learning environments, but facilitation (rather than teaching) and starting with a problem (rather than its use after presentation of theory) are less common. The original concept of PBL in medicine grew from ideas promoted in the 1960s by faculty members developing a new curriculum at the medical school at McMaster University, Ontario, Canada (Barows and Abrahamson 1964, Hamilton 1976). Similar learning methods were already in place in other disciplines, for example, the Casebook Method pioneered at Harvard Law School by Christopher Columbus Langdell (Langdell 1983). Amongst the medical profession, allied health professions and other disciplines in both the undergraduate and postgraduate education environment, interest in PBL has grown considerably since that time.

Early definitions of PBL in medicine focused on the idea that groups of students would work together on a problem to identify gaps in their knowledge and decide what information they needed to acquire in order to manage that problem (Barrows and Tamblyn 1980). Barrows outlined a variety of approaches that could be used in PBL. He described use of a number of different types of problem as a starting point for learning, which included lectures and real patients (Barrows 1986). It is apparent from the literature that an assortment of teaching and learning practices fall under the umbrella term of PBL. It is also clear that PBL has been a source of controversy in the medical community. Arguments as to whether PBL was better than what had gone before, in so called traditional medical schools, were played out in the medical literature and there was a rapid rise in publications relating to medical education (Distlehorst and Barrows 1982, Norman and Schmidt 1992, Albanese and Mitchell 1993, Schmidt 1993, Bligh 1995, David 1999, Harden 1999, Maudsley 1999, Colliver 2000, Dolman, Giuselaers et al. 2002, Prideaux 2002). The medical profession became split with advocates and opponents of PBL locked in heated debate (Norman and Schmidt 2000, Prideaux 2002). One of the difficulties was that there was no clear definition of either PBL or traditional medical school teaching.

PBL in medicine

PBL tutorials can be conducted in a variety of ways. In medicine, as outlined in the British Medical Journal (Wood 2003), a PBL tutorial typically involves a small group of students who meet regularly to discuss a problem. A tutor normally facilitates

groups. Groups typically stay together for several sessions ranging from a few weeks to several years. Groups normally allocate students to the role of 'chair' and 'scribe' for each session and these roles are rotated round the group.

The PBL process

A PBL tutorial is typically divided into three phases: brainstorming, independent study and reporting back.

1) In the brain storming phase students normally discuss a 'problem'.

2) During independent study, students have time ranging from a few hours to a few weeks in which to study a topic.

3) In reporting back students usually present new knowledge to discuss with the group.

The PBL case

A PBL case (sometimes called a scenario or problem) usually contains clinical material for the students to discuss. It might be, for example, a patient history or investigation results. Cases are presented in written form, but with more modern technology, they can be presented in other ways e.g. audio or video recording. The case is used as the starting point for learning. In more traditional learning environments, cases are typically given to students *after* they have been provided with theory and principles and used as an exercise in which the student can apply knowledge. In PBL, it is the other way around.

The PBL tutor

The role of the tutor is to facilitate the students to learn rather than to impart knowledge. The PBL tutor is typically a faculty member but not necessarily an expert on the PBL case.

The PBL chair (student)

The chair is expected to coordinate contributions from students and lead the discussion

The PBL scribe (student)

The scribe is expected to record the discussion and make notes of areas that are identified by the group to be a further learning need.

PBL at Norwich Medical School

Norwich Medical School opened in 2003. PBL was at the centre of the curriculum. Each PBL case scenario was designed to fulfil a list of faculty-defined learning outcomes which could be achieved by the students through discussion of the case in the PBL setting, and supported by independent study and attendance at lectures, seminars and placements. PBL is used at Norwich Medical School throughout the 5 years of the undergraduate medical curriculum. PBL groups consisting of 10 medical students and a tutor take part in 22-25 tutorials per academic year. Groups stay together for one academic year and when possible, keep the same tutor. Students frequently work with their PBL group members in other learning settings, for example, they will often attend clinical placements together and travel there in a minibus if it is some distance away. The groups get to know each other very well.

PBL is one of the many learning opportunities available to the students in the diverse undergraduate medical curriculum at Norwich Medical School. In addition to PBL, students attend lectures and tutorials, and take part in practical sessions, for example, anatomy dissection and clinical skills training. They are also given the opportunity to undertake student selected studies and individual projects, spend time abroad on an elective, and shadow an FY1 junior doctor before taking up their first post. Naturally, students spend a lot of time in private study.

At Norwich Medical School, the PBL process is divided into the three typical phases: brainstorming, independent study and reporting back.

1) **Brainstorming;** through discussion, students are expected to decide what they already know and what they need to learn more about in order to fully understand and explain the concepts of a medical case. One feature of the PBL process at Norwich Medical School that differs from PBL in some other medical settings is that students in years 1 to 3 are expected to produce written work for each other. This requires students to decide how to divide up the topics to be studied.
2) **Independent study;** students typically have one week between PBL sessions during which time they attend lectures and seminars, go to clinical placement, undertake practical sessions and engage in private study. The teaching activities for the week are centred on the clinical topics contained in the PBL scenario. By the end of the week, students will have had

opportunities to study the topics of the learning outcomes in a variety of different ways.

3) **The reporting phase;** in this part of the session, students are expected to present/explain/teach the topic that they were allocated to individually research. Students learn from each other facilitated by the tutor. They are encouraged to engage the other students in discussion to enhance and consolidate learning.

My position at the start of my research was that I was aware of being in an environment in which PBL was considered a very special, unique way of learning. Although my tutorials ran well in general, and students came very well prepared with information which they explained to the group, I was struggling to get students in my tutorial groups to perform brainstorming in the way that I understood it should work from the descriptions of PBL in the literature, and indeed from the guidance given by the medical school.

Research focus

Brainstorming is one of the defining features of PBL. For this reason, I felt it was an important aspect of the learning method and I wanted to work out how to make it work better. It is standard practice in PBL for students to start by discussing a case scenario. I found I was not alone in struggling to get students to do it well. It was a frequent discussion point in tutor support groups and it was an aspect of PBL that many tutors and students struggled to perform (Appendix 1). The goal of my research project was to identify ways in which to improve the dialogue in brainstorming in

PBL. In order to do this, I collected data through direct observation and recording to see what was happening in brainstorming in PBL tutorials in Norwich Medical School.

Thesis structure

In the following chapters I reflect on the concept of PBL and its origins. PBL was promoted as a new and exciting education method and promoted as a way of learning that was different and better to what had gone before in so called traditional medical schools. I consider to what extent the pedagogy of PBL is different through exploration of its theoretical underpinnings in relation to educational principles.

In Chapter 2, I consider the relevance of the practical guidance to local application and the difficulties of implementation in the diverse contexts in which PBL are applied. I reflect on the limitations of the guidance for self-development as a PBL tutor. I also reflect on the difficulties on researching in one's own institution.

In Chapter 3, I explain my research philosophy and how this changed throughout the course of the project. I describe the difficulties of undertaking educational research in the real world and I outline the factors that influenced my decision about research design. I describe conversation analysis and how it can be used to explore classroom dialogue. Conversation analysis is an approach to the study of social interaction and how people may be seen to demonstrate an understanding of social rules through analysis of the organization of conversation (Ten Have 1986). It originates from the work of Harvey Sacks (Schegloff and Sacks 1973) following the ethno-methodological work of Garfinkel (Garfinkel 1967). I outline the research

process including participant recruitment, data collection and development of a coding framework.

In Chapter 4, I present transcripts of the data extracts from five tutorials and alongside, I present my analysis notes and coding.

In Chapter 5, I describe the background to the five tutorial groups. I present a classification of different questions types used by the tutors, and the effect these had on the subsequent dialogue patterns that took place in the tutorials. I also identify contextual factors that impacted on the ability of the students to engage in elaborative dialogue in PBL.

In Chapter 6, I offer some explanation for the findings from my research. I describe the difficulties experienced by both the students and the tutors in achieving effective communication in PBL brainstorming and offer insight into the factors that affected discourse. I consider the strengths and weaknesses of the research method I used and highlight ways in which my findings challenge theoretical claims about the unique pedagogy of PBL. I describe ways in which others wishing to improve communication in PBL tutorials can replicate my research findings and methods.

In Chapter 7, I provide an overview of my research and a summary of my findings. I outline my recommendations for PBL tutors and describe how my research adds to the field of literature on PBL.

CHAPTER 2 Literature Review

This chapter puts my research into context by providing background information on the literature relating to Problem Based Learning. In order to develop my understanding of the pedagogy and to enhance my practice as a tutor, I began to research PBL.

My literature review for this thesis focuses on four main areas: the origins of PBL in the medical curriculum, PBL learning theories, the practice of PBL and evidence for effectiveness of PBL.

The literature search

I searched the University of East Anglia library database which is linked to Medline, for publications about PBL. The term Problem Based Learning alone elicited 12,211 citations but not all were relevant to my research area. I narrowed my search to include the three terms that were important in the context of my research field: 'problem based learning', 'medical education' and 'undergraduate'. This produced about 1500 citations in 2013 and by 2018 this had increased to 1899. I manually explored the titles of these articles and the abstracts to identify literature relevant to my research interests. My selection criteria were articles that explored implementation of PBL, PBL pedagogy, descriptions of PBL in practice and evidence for effectiveness of PBL. I also chose publications from the reference lists contained in the articles selected. In addition, I conducted a search for information and resources relating to PBL on the internet using the search engine Google. The

internet search identified several books and websites and on-line publications. I also explored PBL in other context and the wider education literature on discussion-based learning.

Definitions of PBL

PBL is a form of small group teaching. Early definitions of PBL in medicine focused on the idea that groups of students would work together on a problem to identify gaps in their knowledge and decide what information they needed to acquire in order to manage that problem (Barrows and Tamblyn 1980). Barrows outlined a variety of approaches that could be used in PBL. He described use of a number of different types of problem as a starting point for learning, which included lectures and real patients (Barrows 1986). Others defined PBL more broadly describing areas that were important for learning to be considered as PBL, for example, a curriculum organised around problems that involved small group work, or, outcomes related to skills and motivation and the development of life-long learning (Walton and Matthews 1989). By contrast, PBL was also defined by specific characteristics which needed to be included: use of stimulus material to help students discuss an important problem, presentation of the problem as a simulation of professional practice, appropriate guidance of the students by a tutor, and, students working cooperatively, identifying their learning needs and reapplying knowledge to the original problem (Boud and Feletti 1991). With the many descriptions of PBL came confusion. Many innovations that probably spread beyond the boundaries of the original PBL definitions were labelled as PBL.

The framework I use for my study is a definition of PBL that encompasses the wide variety of practice in medicine comprising: 1) learning in small groups, 2) teacher-facilitated group learning, 3) learning by means of self- study, and 4) learning by means of problems that are first discussed in the group (Dolmans and Gijbels 2013).

The diversity of PBL

PBL is used in a wide range of disciplines and there are a wide variety of practices that fall under the umbrella term PBL. Boud and Feletti provide descriptions of PBL in different professions; mechanical engineering, social work, optometry, architecture, nursing, law, computer science, business, and management. I have chosen just two to illustrate the diversity (Boud and Feletti 1991).

In mechanical engineering, concern was expressed that students were too focused on technical theory rather than application in practice. PBL was introduced as a solution to this. In this version of PBL, students tackled problems in groups of three or four and each group of students was required to solve a problem. The course had three phases, each lasting six or seven weeks, and ending with a presentation. Students attended a compulsory tutorial at the beginning of the course, designed to explain the PBL pedagogy and provide guidance on the requirements of the course. They were presented with a bibliography of textbooks and printed notes and they also attended subject specific lectures. Other than this, students worked mostly independently of tutors but were free to seek guidance from the tutors if needed. Assessment at the end of the course was by oral presentation, written reports and a test of understanding. The test of understanding was introduced because there

was some concern that without individual assessment, there were some 'freeloaders'. The authors gave an account of the students' initial reaction to the new course and described how their fear of the unknown turned to enjoyment as well as how the success of this course led to the conversion of a few other lecture courses to a similar format.

In computer science, it was highlighted that an essential skill for an effective consultant is technical knowledge, and an ability to apply this knowledge in an industrial or commercial environment as well as, to be able to operate in a team. PBL was introduced as a method to enable students to develop these skills.

Students took part in group modelling exercises over four years, in which they worked in small groups in consultation with personnel from industry and commerce. In the first year, students worked with the city council. They were provided with a problem related to traffic flow through the city and a bypass. The students were asked to recommend methods for collecting data. An engineer gave them an introductory talk and then the same engineer listened to the solutions that they delivered in a presentation. The assessment was related to group function and delivery of material.

In the second year of the course, the students worked with local industry. They were given a problem and asked to develop solutions. The students were taken to the company to observe the manufacturing processes and asked to produce a written report and give an oral presentation. In the third year, students worked

with managers. They were provided with instructions for a game which had been developed to enhance awareness of the need for good communication and stock control policies. Students played the game and were then asked to make an oral presentation of proposed revisions. In the last year of the course, students worked on an industrial group project. They had to organise weekly meetings, take minutes, produce reports and make oral presentations. Students were assessed by written reports and oral presentations by both the academic and industry staff.

These two examples provide a taste for the huge diversity of learning that can fall under the umbrella term PBL. In some respects, these examples bear almost no relationship to the PBL methods used in Norwich Medical School. There are some similarities however in that; the students were given a problem as a starting point, they worked as a group, undertook independent research, and reported back. These examples highlight how the design of the curriculum and problems that the students were given were related to the students' subsequent work environment. The curriculum designers were able to adapt the method to their learners' needs.

The origin of PBL in the undergraduate medical curriculum

Problems with medical education had been highlighted as far back as the early 20th century (Flexner 1910). One criticism, even at that time, was that didactic methods were hopelessly antiquated and belonged to an age of accepted dogma, or supposedly complete information, when the professor knew and the student learned. A description of the undergraduate medical student environment is outlined vividly in 'Boys in White' (Becker 1961) which is a detailed ethnographic

account of medical education in the late 1950s in America. At that time, the medical school curriculum, for the first two preclinical years, was based on basic medical sciences which were not related to the job of being a doctor. Information was delivered to large groups of students in lecture theatres. Morale was low and the dropout rate was high. It is probably the best description we have of, so called, 'traditional' medical school teaching.

The concept of PBL grew from ideas promoted by faculty members at the medical school at McMaster University, Ontario, Canada (Barows and Abrahamson 1964, Hamilton 1976). They had identified problems with their curriculum and were involved in developing the new curriculum. John Hamilton, chairman of the MD education committee at McMaster University, highlighted his concern that medicine, and medical education, had drifted away from the needs of society at large, and he saw the new curriculum as an opportunity to develop a solution to some of these problems. Although new to medicine, similar ideas to PBL were already in use by other disciplines, for example, in Harvard Law School. Christopher Columbus Langdell is credited with the introduction, in 1870, of the 'case method' in law which has similarities to PBL in medicine (Langdell 1983).

Amongst the medical profession, allied health professions and other disciplines in both the undergraduate and postgraduate education environment, interest in PBL grew and has continued to grow. Evidence of this can be seen by the increase in the number of publications related to PBL in table 1 and figure 1.

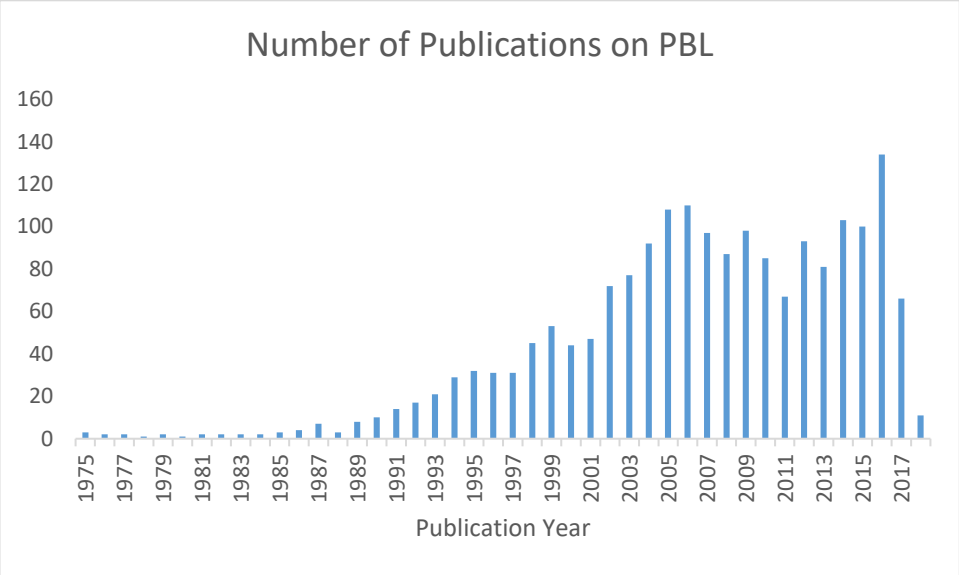
Table 1. The number of publications on Problem Based Learning 1975-2018

Publication year	Number
1975	3
1976	2
1977	2
1978	1
1979	2
1980	1
1981	2
1982	2
1983	2
1984	2
1985	3
1986	4
1987	7
1988	3
1989	8
1990	10
1991	14
1992	17
1993	21
1994	29
1995	32
1996	31
1997	31
1998	45
1999	53
2000	44
2001	47
2002	72
2003	77
2004	92
2005	108
2006	110
2007	97
2008	87
2009	98
2010	85
2011	67
2012	93
2013	81

2014	**103**
2015	**100**
2016	**134**
2017	**66**
2018	**11**

https://www.ncbi.nlm.nih.gov/pubmed/?term=Problem+Based+Learning+AND+Medical+Education+AND+Undergraduate updated 30.03.2018

Figure 1. The number of publications on Problem Based Learning 1975-2018



https://www.ncbi.nlm.nih.gov/pubmed/?term=Problem+Based+Learning+AND+Medical+Education+AND+Undergraduate updated 30.03.2018

Concern about knowledge decay

Howard Barrows, a neurologist working in McMaster's medical school at the time that the new curriculum was being introduced, was a huge supporter of the new ideas being developed using small group work. It was he who was subsequently

responsible for much development of PBL and its promotion and popularisation. Barrows' motivation for the development of PBL was, that he felt students forgot much of what they had learned in the preclinical curriculum by the time they got to the clinical stages of their course. He believed knowledge decay was a problem for students in the traditional undergraduate medical curricula of the day. He states; *'Students had, for the most part, good techniques in performing a neurological history and physical examination, but they seemed to have a paucity of basic knowledge that they could apply to the medical problem. This seemed paradoxical to me as I had been closely associated with and contributed to the students' prior courses in neuroanatomy, neurophysiology and clinical neurology. I knew that these students had been exposed to and passed excellent detailed courses (Barrows and Tamblyn 1980 p.ix).* In his report, Barrows does not provide data to back his claim but supports his belief by referencing two papers by Miller (Miller 1962). The paper by Miller is not an original research paper; it is a text version of a presentation. David (1999) highlighted that, in the presentation, Miller mentions a study which he claims produces evidence of knowledge decay but does not give details and no reference is given (David 1999). It is not certain where the study was undertaken or where it was published, if indeed it ever was published. The second paper referenced by Barrows entitled '*The Contribution of Research in the Learning Process. Medical Education 12(5):28, May 1978*' is not possible to locate and is possibly incorrectly referenced. So, though Barrows' perception was that there was knowledge decay, we have no firm evidence.

PBL as a solution to knowledge decay

Barrows theorised that presentation of a problem, as the starting point of learning, would lead to better medical knowledge retention. He claimed the problem would serve '*to challenge the learner with patient problems and other problems that will be faced in practice both as a stimulus for learning and a focus for organising what has been learned for later recall and application to future clinical work' (Barrows 2000 p.3).* Barrows backs this claim by drawing on research to explain why starting with a real life problem would help students learn. He quotes a study by Godden and Baddeley that describes improvement in knowledge retention by learning in context, but he does not critically appraise this research (Godden and Baddeley 1975). In the study, divers were asked to learn a list of words on land and underwater. They were assessed in the same environment in which they were taught and in the opposite environment. The authors of this study state that, knowledge recall was better when the divers were assessed in the same location in which they were taught. The conclusion was that recall was better when the assessment took place in the same environment as the learning, though the difference was recognised to be minor. The study itself was small, hampered by bad weather and relied on simple recall of data. The extent to which this can be extrapolated to medical education is questionable.

Nevertheless, the implementation of PBL was successful in McMaster's medical school. The team began to promote their new method and other medical schools

adopted PBL. It began to grow in popularity and a new university in Maastricht in the Netherlands was set up in 1976 based entirely on PBL principles.

PBL started to acquire believers in what some have likened to an evangelical manner and it has continued to spread worldwide. John Hamilton, chairman of the MD education committee at McMaster University, came to London in November 1974 to present the McMaster's curriculum at the Horder memorial lecture at St Bartholomew's Hospital. The lecture was subsequently published in the British Medical Journal (Hamilton 1976).

The introduction of PBL in the UK; problems with medical education

PBL was not immediately taken up by medical schools in the UK, but by the 1990s, applications for UK medical schools had dropped and there was concern that increasing numbers of doctors were disillusioned. A television series and subsequent book 'Doctors To Be' (Spindler 1992) described how long hours, low morale and high stress levels were affecting the profession. The undergraduate medical course was cited as contributing to the demoralisation of doctors by failing to prepare them adequately for the realities of professional life' (Lowry 1992). A series of high profile articles was published in the British Medical Journal which outlined problems in medical education. The first article opened with the statement '*Something is seriously wrong with medical education in Britain'* (Lowry 1992 p1277). This could not be ignored.

The overcrowded curriculum

A major concern was that the UK medical undergraduate curriculum had become hugely overloaded. The General Medical Council called for medical schools to reduce factual load (GMC 1993). The GMC is a public body that sets standards for medical schools and postgraduate medical education in the UK. It acts as the overall regulator of medical schools, doctors and standards, but it does not dictate the content of curricula and has no examining powers. The GMC previously made recommendations with regard to undergraduate medical education, but it had resulted in little change in practice (GMC 1957, GMC 1980). The next time however was different. A report was commissioned by the King's Fund which is an independent policy institute, part-funded by the NHS and involved with work relating to the health systems in England. It advised that doctors of the future needed to be able to identify their knowledge gaps and be able to direct their own learning to fill these gaps. Flexibility of the curriculum was called for and the old instructive methods were seen as outmoded (Towle 1991). By the late 1990s, in response to these recommendations and growing discontent, UK medical schools were looking for solutions.

PBL as a solution to the overcrowded curriculum

PBL was identified by medical schools as a flexible learning tool to provide a solution to the overcrowded curriculum and it was introduced in the late 1990s by Manchester University and Liverpool University Medical Schools (David 1999), followed by Glasgow University and Imperial College University of London medical schools. Other medical schools followed later but some, notably the older

university medical schools (Oxford, Cambridge and UCL), refused to embrace the new ideas.

The profession was split with advocates and opponents of PBL locked in heated debate, and arguments as to whether PBL was better than what had gone before were played out in the medical literature (Albanese and Mitchell 1993, Vernon and Blake 1993, Bligh 1995, Albanese 2000, Colliver 2000, Neville 2009, Schmidt, van der Molen et al. 2009)

Educational theory

Educational theory attempts to explain how we learn. For many years, educational theory had been the domain of psychologists, but the introduction of PBL into the undergraduate medical school curriculum appeared to spark interest amongst the medical profession and discussion of educational philosophies began to appear in the medical literature.

PBL was not actually developed from educational theory. The originators of PBL admitted to having no background in education other than their experience of teaching medical students (Barrows and Tamblyn 1980). Later, Barrows and other advocates considered PBL in relation to several educational theories to both explain how PBL worked and to defend its use (Barrows 2000).

Discussion as a way of teaching

Learning theories that emphasise the importance of self-conceptualisation of knowledge, rather than memorisation of fact, combined with modern access to

information, have revolutionised the role of the teacher in the classroom. The teacher's importance as a source of knowledge has also declined in the western world with widespread access to information through the internet. There are still many facts that a medical student is required to learn, and these are necessary building blocks in order to understand the workings of the human body, but they can be learned in a variety of ways; anatomy for example can be learned in the traditional way – by attending a lecture, reading a book and through dissection, but models and computer aided technologies are now widely available at reasonable cost. In addition, discussion can be used and can help students with conceptual understanding, recall and customary pronunciation of long Latin names.

Other aspects of medicine, for example, ethics, are less precise than anatomy. Patients and doctors will have a range of views which may change and vary according to circumstances. Discussion can help students to consider the wider issues, and help them to appreciate others' points of view, to enable them to develop their understanding of the concepts and examine their beliefs.

Brookfield's publication (Brookfield and Preskill 2010) 'Discussion as a way of teaching' is a valuable text for university lecturers and provides guidance on how to facilitate discussion to take place between learners. It highlights the difficulties of enabling discussion. The book provides advice on asking the right question in the right way. In the many examples provided however, it is usually assumed that the teacher is knowledgeable about the subject about which the students are learning, and so, they can focus the discussion to areas of importance. Much of the advice is

transferable to the PBL setting, but the techniques have some limitation for PBL tutors at Norwich Medical School who must stimulate discussion sometimes without expert knowledge of the study area.

Discovery learning

Barrows can be seen as an early adopter, in medicine, of the ideas of discussion as a way of learning. Barrows related the PBL method to discovery learning which emphasises the importance of students discovering things for themselves rather than learning by rote (Barrows and Tamblyn 1980). Discovery learning originates from ideas based in constructivism which suggests that learning takes place through a series of active steps by which the learner builds knowledge (Bruner 1961). Bruner's work built on ideas promoted by Piaget in the early part of the century who encouraged teachers to consider that learning, especially in childhood, is more effective when engagement in activity is promoted rather than by passive reception of facts (Piaget 2001). Piaget highlighted the need for the learner to develop interest in a subject and set his or her own learning goals. At a time when most medical schools were delivering large quantities of information by lecture, and assessments were designed to demonstrate accumulation of facts through rote learning, these ideas were innovative.

Self-directed learning and andragogy

Barrows described PBL as a form of self-directed learning. He states, *'There is an increasing concern that the curricula of many medical schools put too heavy an emphasis on memorization of facts, and little stress on problem-solving or self-*

directed study skills necessary for the practice of medicine. Problem based, self-directed learning is a teaching-learning method specifically designed to emphasize these skills and to increase the retention of facts and their recall in the clinical situation. This approach, built on research into the problem-solving skills of physicians and principles of educational psychology, is employed by several medical schools and serves as an antidote to the many educational abuses seen in more traditional approaches' (Barrows 1983 p3077).

In many publications, self-directed learning and problem based learning are intertwined (Distlehorst and Barrows 1982). Self-directed learning has been defined as a process in which individuals take the initiative without the help of others in diagnosing their learning needs, formulating goals, identifying human and material resources and evaluating learning outcomes (Knowles 1975). Knowles considered self-directed learning to be a very important component of the way that adults learned. He developed a theory of adult learning that he called 'andragogy' to match the childhood learning theory of pedagogy. He suggested there were differences in the way that adults aged over 18 learned, compared to how children aged under the age of 18 learned (Knowles 1975). He outlined how the principles of adult learning should:

1) Involve the adult in the planning and evaluation of learning,

2) Incorporate their prior experience,

3) Focus on things of relevance to them and

4) Be problem focused.

The similarities with these ideas and those of PBL are clear. In more recent years andragogy has been subject to considerable debate. There is a question as to whether there is a difference between how adults and children learn (Hanson 1996). Knowles was in later life to concede that certainly there was no neat age cut-off point at 18 between andragogy and pedagogy (Knowles 1989). Others have gone so far as to say that what Knowles described was closer to good education practice rather than a learning theory at all (Levitt 1979)

Activation elaboration hypothesis

Professor Henk Schmidt, a psychologist, has extensively explored the theoretical underpinnings of PBL. He claims there are specific learning theories to explain how PBL works (Schmidt 1993). Schmidt claims that initial discussion of the PBL problem activates students' prior knowledge and that this facilitates new knowledge acquisition. Schmidt draws on his own research and on a range of other relevant research in the field of medicine and in other educational environments to explore the activation elaboration hypothesis. The author's research involves observation of students in a classroom setting.

Schmidt undertook a series of studies aimed to elucidate the role of prior knowledge in activation and elaboration in the initial discussion of a problem. He describes how he presented students who had previously studied osmosis with either a) an osmosis related problem called 'red blood cell problem', in which students were asked to discuss, for example, why it burst when put into fresh water

or b) a problem unrelated to osmosis. He later assessed how well students who had discussed the red blood cell problem remembered facts about osmosis compared with students who had discussed an unrelated problem. He found that students who discussed the red blood cell problem recalled almost twice as many facts about osmosis as those who did not.

There are some issues with the study. We are not told whether the students were matched for prior knowledge of osmosis and Schmidt acknowledges that it is not possible to distinguish activation of prior knowledge from knowledge learnt from other students during the initial discussion.

In another study, two groups of students were asked to observe a video recording of students discussing a problem (Schmidt, De Volder et al. 1989). One group were asked only to observe a video recording. Another group were asked to observe the recording and were prompted to elaborate on the material several times during observation of the video. They found that students who were prompted to elaborate recalled more information later. Again, methodological issues of matching are not described, but also, the outcomes were not compared with other methods of enhancing knowledge, for example, pre-testing.

What emerged from these studies is that elaboration and verbalisation seem helpful in learning. Knowledge retention appears to be increased by elaboration and verbalisation. This could be created in settings other than PBL of course. Verbalisation versus non-verbalisation was assessed, but comparison was not made

between students who had the opportunity to verbalise in PBL with those who had the same opportunity in another learning environment.

In summary, the studies explore verbalisation and elaboration in two settings, but they do not compare these with their use in other learning environments. Further exploration would be needed in other learning environments to explore whether elaboration and verbalisation in PBL had advantage over any other setting.

Situational interest hypothesis

Another explanation for how PBL works is that the PBL group provides motivation that supports cognitive change, and that the presentation of the problem arouses situational interest which drives learning due to the enigmatic nature of the problem (Schmidt 2011).

Interest, or liking and engaging in a cognitive activity plays an important part in the learning process. It determines what we learn, how much we learn and whether we retain the information. Theoretical discussion of the role of 'interest' dates back to John Dewey (Dewey 1897). One of the most important findings to emerge was that interest is a multifaceted phenomenon. Interest can be broadly divided into two types: personal interest and situational interest. Personal interest is characterised by intrinsic desire to understand a topic. This persists over time and an individual will carry it with them from place to place. In contrast, situational interest is more transitory. It is environmentally activated and context-specific; it is a temporary interest that arises spontaneously due to environmental factors such as a task or an engaging text. Situational interest can fade as rapidly as it emerges

though so, although personal and situational interest may both affect learning, they probably do so quite differently.

Schmidt outlines a study in which he attempts to measure situational interest (Rotgans and Schmidt 2011). In the study, students were asked to self-evaluate their situational interest and tutors were asked to provide feedback about student engagement at various times throughout the day in a 'one day' PBL study day. Situational interest is very difficult to measure, and use of a validated tool is described. Situational interest was measured five times during the day. It was found to be increased immediately after presentation of the problem, appeared to decrease throughout the day, but then it was seen to increase again in the reporting phase of PBL (Rotgans and Schmidt 2011).

The authors report that presentation of the problem increased situational interest. Presentation of new material could arouse situational interest in other learning environments too, however. For example, situational interest might increase when a lecturer begins talking, or when students start to learn about a new topic when reading about it in a book. So, we don't know if presentation of a new topic alone raises situational interest in any context. The study does not explore situational interest in any learning environment other than PBL.

In conclusion, PBL was not developed from educational theory. Several educational theories were applied to PBL laterly to both explain how it works and defend its use. It is not clear whether there is a unique element to make PBL a completely

different learning pedagogy, or if it just describes good learning and teaching practice. Many of the elements that can be demonstrated to aid learning in PBL could also aid learning in other learning environments.

The problem as a starting point for learning

The problem as the starting point for learning is a distinctive feature of PBL. A description of PBL in Wikipedia describes it as a student focused pedagogy in which students can learn about a subject through experience of '*solving an open ended problem found in trigger material' (Wikipedia).* In medicine, however, Wood (2003) disagrees that PBL is about problem solving. She advocates that appropriate problems are used to increase knowledge and understanding, because presentation of clinical material as the stimulus helps students to understand the relevance better (Wood 2003).

Barrows' original ideas about the problem were that it would enable students to learn in context to enhance recall of knowledge, to serve as a stimulus for learning, and be a focus for organising what has been learned for later recall and application to future clinical work *(*Barrows 2000*).* He also expanded on the role of the problem as a tool to facilitate clinical reasoning and to provide help with motivation and self-directed learning (Barrows 1986). He described how problems could take many forms depending on the desired learning objectives.

Azer (2008) outlined many functions of the PBL problem; helping students with acquisition of a knowledge base that would be easy to retain, development of clinical reasoning and problem-solving skills, development of self-directed learning

skills, development of professional attitudes and non-cognitive skills e.g. empathy, communication, and interpretation skills and encouragement of independent and critical thinking.

Schmidt's take on the function of the problem was that it needed to engage students in discussion, lead to identification of learning issues, and stimulate self-directed study. In order to do this he advised that certain characteristics were important in a problem and that it should be interesting, authentic and adapted to the student's level of knowledge *(*Schmidt 2011*)*. Research relating to the content of text-based features that promote situational interest are suggested to be; unexpectedness of information, character identification, activity, coherence and completeness, information complexity, suspense, vividness, imagery and ease of comprehension (Rotgans and Schmidt 2011).

Savin-Baden and Howell Major (2004) highlight the lack of clarity that surrounds the purpose of the problem in PBL in medicine (Savin-Baden and Howell-Major 2004). They question whether we are asking students to solve clinical problems, or to use their experiential and propositional knowledge to manage a case, and whether the problem is simply to trigger to make students to think and identify learning needs, or to provide a context in which to hang information.

The reality is that problems can be designed to do many things as Barrows originally stated. The actual function of each problem will be dependent on the content and the way the problem is set out and structured. In medicine therefore the problem

can have a variety of roles; stimulating students to want to learn, helping students develop clinical reasoning skills, activating prior knowledge, serving as a guide to the curriculum and being a focus to trigger discussion. So, the question is, how can we write problems to achieve these goals?

How to write a PBL problem for medicine

Dolman and Snellen-Balendong (1997) explored the theoretical and practice literature relating to the problems in PBL and produced a set of principles for case design (Dolmans, Snellen-Balendong et al. 1997). The authors adopt a positive value stance in relation to the expectation that PBL can be improved by effective case design with the implicit research questions a) to what extent is there evidence based knowledge about effective case design and b) how can this be used to develop principles of effective case design? They harness theoretical ideas about how learning takes place to focus the research question, and they use this as a basis on which to justify the seven principles that they describe for practice.

Principle 1 Prior knowledge: *'Ensure the content of the case adapts well to student's prior knowledge because it will help the student mobilise what they already know about the contents of the case. Look at the curricular materials students have been confronted with previously.'*

The ideas are theoretically sound but there are difficulties in getting these ideas to work in practice. They suggest that looking at the course materials may be useful, but of course these may or may not relate to what students know, and no suggestion is given as to how to establish the level of prior knowledge. In addition,

an assumption is being made that a student's prior knowledge will be uniform, but in a group learning process, students will come with varying knowledge. Methods of dealing with the range of student's prior knowledge within the group are not addressed. In addition, it does not deal with the idea that medicine may not be a linear subject so that material can be covered in a variety of sequences.

Principle 2 Elaboration: *'Ensure that the case contains several cues that stimulate discussion and encourage students to search for explanations. The case should however not contain so many cues that the task for the students consists of separating out relevant cues from non-relevant cues. Pointless cues will distract students'.* It is claimed that new information will be better understood and recalled if students are stimulated to elaborate on it. The authors describe how elaboration can take different forms: discussion, answering questions, asking critical questions or giving explanations. They suggest that these activities will '*increase the number of relations between concepts and the number of details in student's semantic networks and will lead to a sophisticated knowledge structure...*' but we are left to guess how these can be measured. We are not provided with any clear guidance about how to construct cues which may make students elaborate or that would stimulate discussion.

Principle 3 Relevant context: *'Preferably present a case in a context that is relevant to the future profession or at least show the linkage to the future profession'*. The authors state that '*research on human memory shows that information is better recalled if the context in which the information is applied closely resembles the*

content in which the information is learned'. They refer to an educational theory that the reason for this is that the knowledge is *'stored in the same cognitive structures.'* They do not give references or any evidence that this is the case. They suggest that this implies students should be '*exposed to some professionally meaningful problems or situations that have a strong resemblance to the problems they will be confronted with in their future profession'* and conclude that the case should be '*presented in a context that is relevant'.* If we are to fully embrace this, surely it would mean bedside teaching in a hospital ward or general practice would be better rather than a PBL classroom?

Principle 4 Integration of knowledge: *'Present basic science concepts in the context of a clinical problem'.* They suggest there is evidence to show that integration of basic science knowledge and clinical knowledge results in '*better diagnostic performance'.* We are not told how the 'diagnostic performance' is measured or how robust the evidence is.

Principle 5 Self-directed learning: *'Ensure that the case encourages students to generate learning issues and conduct literature searches. This implies that the case should not be too structured. A case that contains specific references that need further explanation or a case containing references to literature providing solutions to the issues raised in the case will not prepare students to become more accomplished self-directed learners.'* The authors also suggest that in PBL, students should '*decide for themselves what is relevant'* for their learning, but how students

balance this with the need to achieve specific learning objectives of the curriculum in order to qualify as a doctor is not explained.

Principle 6 Interest in the subject matter: *'The case should sustain discussion about possible solutions and facilitate students to explore alternatives in order to enhance their interest in the subject matter. This can be done by presenting phenomena in a case that needs further explanation. In addition, gearing a student's perception of their environment will also enhance their interest in the subject matter.'* The authors suggest that intrinsic interest will extend time spent on self-study and that self-study will positively influence performance. They suggest that by presenting phenomena that need further explanation, intrinsic interest will be raised, but of course this could be equally well done in another learning context.

Principle 7 Faculty objectives: *'Work out what faculty objectives students will be confronted with while analysing and studying the case.'* The suggestion is that the case should be written first, and the objectives fitted to this rather than the other way around. This piece of advice seems logical, as it would appear to result in a more authentic storyline for the case. However, there are difficulties with this approach in fitting the rest of the curriculum around the case and issues of what to do in order to update cases are not addressed.

This guide contains useful general advice, but it does not explain in detail how to write different cases for different purposes. Many of the features described are generic features of good teaching and learning. The principles are theoretically

sound, but there is little evidence that the PBL brainstorm discussion is better than any other method that may activate students' prior knowledge, or that enhancement of understanding and knowledge retention would not be equally enhanced if the discussion were to take place after the students had learnt the subject rather than before. Many claims are presented with a high degree of certainty, but the theoretical evidence is at variance with the findings of curriculum comparison studies that generally do not report PBL to have effects over and above conventional training (Albanese and Mitchell 1993, Vernon and Blake 1993). The guidance is written as though there is only one type of PBL.

Savin-Baden and Howell Major (2004) suggest that not enough attention has been given to the design of a problem to achieve these different functions. A sentiment with which I am in full agreement. They advise that problem design is very complex and very dependent on the nature of knowledge within a subject area, which therefore makes it difficult to produce a set of generic rules. This is a complex and difficult area about which to make generalisations. It is like trying to teach someone to write a good story or a murder mystery. No doubt some problems will work better than others at promoting situational interest, whether this is specific to PBL and whether there is any additional benefit from this in PBL is not clear. A problem containing these features could of course be presented in other learning environments.

In summary, evidence to support the theoretical ideas, that the problem as a starting point for learning in PBL is a special and different way of learning, is thin.

Guidance is generally theoretically based and there is little empirical evidence that is convincing. Much of the guidance could be generically applied to any teaching environment. As with any teaching or learning, the quality of the content and delivery of the material is vital.

My search for a solution as to how to improve PBL through the writing of 'better' scenarios declined and I looked for different solutions to my problems in brainstorming.

The PBL tutor

A considerable amount has been written about the role of the tutor in PBL, who is a facilitator, not a teacher. Facilitation is the act of helping other people to deal with a process, or reach an agreement or a solution, without getting directly involved in the process. There are several differences between teacher and that of a facilitator. A teacher is usually a subject expert who imparts knowledge, oversees planning a lesson and has authority in the classroom through knowledge and power. A facilitator on the other hand is not a subject expert so s/he needs to help the students to find resources to develop their own understanding of a topic. The facilitator needs skills in the management of group dynamics, and helps the students to plan sessions, but the facilitator is not necessarily in full control and power can be handed to the students.

It has been highlighted that facilitation may not be a role that is familiar to university staff members whose job title is usually lecturer. Savin-Baden (2003) reported that some staff could struggle to make the transition from lecturer to

facilitator. They found that the shift from subject expert to group expert was difficult and resulted in feelings of loss of authority and control. Others have suggested that the role of a facilitator is simply part of the role of a teacher, which includes questioning, probing, reflection, challenging and managing the group in addition to imparting knowledge (Margetson 1994).

How to be a good PBL tutor

Attempts have been made to identify what makes a good PBL tutor. In addition to my role as a researcher and the PBL Lead for the medical school, I was also a PBL tutor so my interest in this was multi-dimensional. Savin-Baden and Howell Major have provided a description of the role of the tutor in stimulating discussion and enabling the team. They suggest that the facilitator should use non-verbal strategies such as scanning the room to check for student participation and engagement and to enable the redirection of questions directed to the tutor to be passed back to other students. They also suggest the use of gestures to bring members into the discussion. In addition, they advise it is important to pick up cues such as a frown of disagreement. Verbal strategies that can be employed are listed, such as asking questions, supporting and valuing students by creating a safe learning environment where students can express lack of knowledge and ask questions, summarising what students have said and suggesting alternative ideas as well as helping students to reflect on what they have learned, and how the tutorial has gone. They base their guidance on a range of factors that are related to facilitation of adult learning in general, not specifically to PBL and specific practical

guidance on how to achieve these aims is not provided (Savin-Baden and Howell-Major 2004).

Azer provides some guidance for PBL tutors on how to run effective tutorials. He uses his experience and evidence from practice in his account and describes questions that could be asked by the tutor using a specific problem as an example. He extrapolates these questions into general guidance rules about how to facilitate the sessions, but he does not delve into depth about the qualities or linguistics of an effective question (Azer 2008).

Some attempts have been made to compare different tutor profiles in relation to intervention styles. There is some evidence that 'subject experts' ask more questions in a tutorial than non- subject experts, and also that groups led by subject experts generate more learning issues, but what is not clear from these studies is the definition of subject expert; this can range from being a doctor to being an expert in the specific case (Maudsley 1999). Schmidt reviewed the evidence in favour of subject experts, but he found it to be inconclusive due to loose definition of subject expert and found that the success of a tutor depended more on the extent to which the tutor intervened or had been 'warned off' intervening in the tutorial process (Schmidt, van der Arend et al. 1993). The precise nature of the interventions was not clear.

Wilkie explored different tutor styles adopted by facilitators in a newly developed nursing diploma programme that utilised PBL (Wilkie 2002). She interviewed tutors

and recorded tutorials. She described how PBL facilitation skills took some time to acquire and that facilitators changed their style over time. She outlined four broad approaches to facilitation that were adopted by the tutors: directive conventionalist, liberating supporter, nurturing socialiser and pragmatic enabler. She described that the directive conventional approach was one that many PBL tutors adopted as novice tutors in which tutors focused heavily on content questioning and knowledge. The liberating supporting approach was one that many tutors felt they were expected to enact. It included letting the students decide for themselves what to learn and how they would learn it, but few tutors felt comfortable in this role. The nurturing socialising approach was student centred and supportive with the emphasis on the students feeling valued. The pragmatic enabler was the approach that most experienced tutors developed over time. In this approach, the tutors were flexible and used a variety of approaches, which were context dependent (Wilkie 2002).

Wilkie found that over time, facilitators tended to converge from a directive conventionalist approach (in which the tutors tended to focus mainly on factual content), towards that of a pragmatic enabler, in which tutors were flexible and responsive to the students' learning needs. She identified that facilitators struggled with the dissonance between espoused PBL theories and the realities of practice. Many identified the liberating supported approach to be the one that epitomized the type of facilitation that was expected in PBL but very few adopted this approach (Savin-Baden and Wilkie 2004).

In summary, the role of the tutor is wide and varied in practice. There is general agreement that the tutor's role is that of facilitator rather than a teacher who imparts knowledge, but many of the skills required of the tutor seem to be generic skills of good teaching. There is little information about ways in which PBL tutors can be self-reflective, and little guidance on how to evaluate one's own questions to make improvements in PBL facilitation to create a more effective learning environment in PBL.

Summary

PBL was first used in medicine in Canada in the 1960s and subsequently spread worldwide as a solution to problems of medical education. There are several educational theories that attempt to explain how PBL works, but a unique underpinning pedagogy remains uncertain. Throughout the last 60 years, many doctors have been trained and graduated from so called 'PBL medical schools' and these doctors are now practicing medicine. There is a wealth of literature relating to PBL practice, advice about how to write a scenario and how to be an effective tutor, but much of this is context specific and cannot be directly applied to other institutions. PBL is often described as if it was one thing, but it encompasses a huge variety of education practices. The diversity of educational practice in medical schools contribute to the impossible task of using outcome based research studies to compare differences in effectiveness of educational methods. I will address this issue in chapter 3.

Research gap

There are many descriptions of PBL in practice and many guides explaining how to do the flavour of PBL used in the author's environment. What has not been explored in great enough depth is the granular practice of being a PBL tutor. For example: What do tutors do in a PBL session? How do they do it? How do they know when to intervene or how much to intervene? What do tutors say and do when facilitating a session.

My research goal was to explore the communication that occurred in PBL tutorials in order to better understand what makes for effective dialogue, and to find strategies to enable tutors to facilitate effective communication between students during brainstorming in PBL tutorials.

My research was designed to answer the question; what communicative strategies can be used by tutors to enhance elaborative dialogue between learners in Problem Based Learning tutorials? At a time when students are vocal about the quality of teaching in higher education establishments, this is highly relevant.

CHAPTER 3 Methodology

In this chapter, I describe my research philosophy and my decision to use an ethno-methodological research approach. I describe my data collection and data analysis processes and provide a detailed description of conversational analysis, because it may be an unfamiliar analysis method for medical educators and clinicians. I describe limitations of the methodologies and challenges I encountered, as well as the strengths.

Research philosophy

Decisions about research require a synthesis of one's epistemological way of viewing the world with one's ontological perspective of ways in which reality can be investigated to decide on a research method. I describe my journey in this respect.

Epistemological perspective

There are two very broad research epistemologies: positivism, in which one views the world as made up of facts and, constructivism, in which one views facts as creations. I outline my position on this continuum. My previous research experience had been heavily influenced by a positivist stance in which I had always tried to distance myself as much as possible from having any effect on data. My initial ideas for the study reflected my ontological position at that time; I wanted to look for evidence for the best way to deliver PBL. My philosophical stance changed during my research.

I began the study as a positivist scientist who believed in a world full of facts just waiting to be discovered, I never questioned that this was not the case. As a doctor and medical educator, I was aware of calls for use of evidence-based teaching to be applied in medical education. Morrison suggests that randomised controlled trial or other robust forms of evaluation should be considered whenever any major educational changes are suggested (Morrison, Sullivan et al. 1999). In the medical world, the double-blind, randomised controlled trial is considered the gold standard. This method involves comparison between groups who receive different interventions where neither the researcher nor the participants are aware of who is receiving which intervention. With this knowledge in mind, I began to plan my study. As I progressed, however, I began to see that this positivist approach had limitations and my belief that I could discover the 'truth' about the best way to deliver PBL declined. I aligned more with an interpretive stance and my research focus altered from 'What is the best way to deliver PBL?' to 'What is happening in PBL at Norwich Medical School, why, and how can we improve it?'

Ontological perspective

The decision to move away from a positivist research stance was not an easy one. It meant moving from a research field known and respected by many of my colleagues to one that was not. This stance could introduce a risk of non-acceptance of the findings. Medical research tends to favour a positivist stance, and medical education research has tended to align with this method. Research attempts in PBL had previously focused heavily on the answer to the question; does

PBL work as well as traditional medical school teaching (Vernon and Blake 1993)? Investigators had endeavoured to make comparisons to explore differences between doctors trained in PBL medical schools and those trained in traditional medical schools, but the conclusions had remained somewhat elusive (Albanese and Mitchell 1983). Results suggesting that PBL trained doctors were better at some things and worse at others were used by PBL advocates to defend PBL, and, by PBL opponents to rebuff claims of success. PBL is sometimes rejected by the medical community on the basis that there is no good empirical evidence for its success (Albanese 2001). The Best Evidence Medical Education Movement (Harden 1999, Webb 2009) has been strong in defence of empirical research. Colliver has argued that it is important to prove PBL works before considering what happens in PBL. He suggested that for PBL to be effective, the entire curriculum must be problem centred and PBL should form the core of the curriculum (Colliver 2000).

Training to be a doctor has historically been a diverse and varied process. The early physicians usually held a university degree whilst surgeons were apprenticed. Surgeons and physicians were separately taught until the mid-18th century when the first medical school opened at the London Hospital, Whitechapel and so medical training became a little more controlled and ordered, but it was certainly not evidence based! Research into medical education is a relatively new field. In Britain, medical education has always developed in a piecemeal fashion following the medical advances of the day. In contrast, PBL was introduced as a fundamental whole scale change and was consequently one of the most heavily researched

educational changes in the history of medical education, but it has also been one of the most contentious, possibly reflecting the coincident greater shift in the focus of medicine towards empiricism.

Qualitative research studies that have explored students' and tutors' experiences of the learning environment in PBL have examined perceptions using interviews and questionnaires (Savin Badin and Wilkie 2004). These provide valuable information, particularly in relation to people's beliefs, but the studies have tended to be at a distance and cannot provide a full account of classroom practice. Differences can exist between what is *observed* to occur in a PBL session and how tutors and students *report* it. Some direct classroom observational methods have been used. Peter Jennings explored graduate entry medical students behaviours in PBL (Jennings 2013) and Margaret Wilkie explored tutors facilitation patterns in PBL. Important information can be gained from these studies about how these different research methods and analysis methods can enable illumination of data (Wilkie 2002). These studies provide rich data and insight into PBL practice, but, as Leung highlights, the diverse nature of PBL means that information obtained in one organisation is not necessarily generalisable across institutions (Leung 2002).

Difficulties with comparative research in education

PBL practice is diverse and variable. Much of what occurs in PBL can also occur in other learning environments. Colliver questions whether the learning context of a PBL curriculum really differs all that much from that of a standard curriculum (Colliver 2000). One issue for PBL is that much of the comparative research is based

on outcomes so that the detail of what actually occurs in a PBL tutorial is difficult to obtain. Fine detailed investigation has been highlighted as both deficient and essential as there is hardly any research or literature about actual tutorial processes (Hak and Maguire 2000). PBL processes can differ considerably among and even within curricula. Empirical research has significant limitations in the exploration of best practice for a diverse method such as PBL.

Heterogeneity

Medical schools often wish to explore the effectiveness of teaching methods, particularly where change has occurred, but evaluation of educational change is very difficult. When considering comparisons in PBL, it is essential to consider the heterogeneous nature of the learning environment and process. PBL is a flexible learning method that comprises four common themes:

- Students meet as a group,
- The tutor is a facilitator,
- Students study independently between sessions,
- Learning starts with a problem (sometimes called a case or scenario).

(Dolmans and Gijbels 2013)

Each of these components contains numerous variables e.g. group size, group functionality, frequency of meetings, different PBL scenarios and different tutor facilitation styles. In addition, learning is a very complex task that takes place within

a student's brain and which is dependent on numerous factors. The content and delivery of taught material, the students' prior understanding of a subject, the perceived relevance and the engagement of individual students as well as the specific teacher can all affect the value of any educational intervention. In addition, not only do many things inside the classroom influence students, but events *outside* the classroom can also be relevant. There are many variables that need to be considered that could account for any differences observed (Norman and Schmidt 2000).

When attempting a comparison, many things need to be considered and the possibility of keeping variables constant except an intervention is negligible: students live in the real world with all its complexities and change. Controlled experimental conditions are impossible, and cross-contamination between groups will occur and needs to be considered; medical students often live in close knit communities so what is learnt in one group can be easily shared amongst other groups.

The need for baseline measures

If comparisons were to be made between groups, baseline standardisation between groups would be necessary. This can be difficult. One possible way to do this is by use of baseline knowledge exams, but these might need to be large and lengthy to capture enough data in order to make calculations meaningful. Effect size is also a factor to consider; large numbers of students would be needed because the effect is likely to be small and also reliant on lower scoring students due to the 'ceiling'

effect i.e. top students scoring maximum or near maximum marks are unable to improve their scores by much whatever the teaching method used (Albanese 2000). In practice, the ceiling effect means that using the output measure of exam results is a greater measure of effect on lower achieving students.

It can also be difficult to get ethical approval for research in which results of student exams that count towards student progress are used. One way round this is to use results of exams that do not count toward a degree, but this may alter student's study behaviour and extra exams would probably be unacceptable to students.

Unplanned change

A frequently changing environment hampers research in the real world. Norwich Medical School, like other educational establishments, is subject to many varied influences. The curriculum is under constant minor reform, which occurs in response to student preference, as a result of tutor feedback and from external influences e.g. changes in medical guidelines or guidance from the GMC. This needs to be recognised in the planning of a research project. Change often occurs imperceptibly and unpredictably. For example, at Norwich Medical School, the PBL tutor body of approximately 90 tutors is in flux due to usual life events such as pregnancy, retirement and moving to a new house, thus changing situations unpredictably.

Confounding factors

Confounding factors are another variable that can be problematic in comparative research. Any feature that differs between the groups and is associated with outcome will act as a confounder. In Norwich Medical School, the same group of students who form a PBL group also undertake other learning together in several different environments other than just PBL. For example, they attend a weekly placement at General Practice. This can mean that any differences found between groups would be difficult to attribute to PBL. PBL sessions are only a small part of the learning process at Norwich Medical School; students spend between 40 and 60 hours a year in PBL sessions but they spend many more hours than this in attending lectures, on placement and of course in private study. These other components contribute a far greater curriculum time and therefore may have a far greater effect on learning. Another problem is that there are only small numbers of students in a group thus meaning differences would have to be large to be detectable.

If one is to consider using large numbers, for example, to make comparisons of student outcomes from different medical schools, one must be aware that in the UK, students make choices about the medical schools to which they wish to apply. They spend time visiting medical schools on open days and they make a medical school selection based on a variety of individual, esoteric factors. It therefore follows that different medical schools may attract different types of students, so comparisons are of limited value unless baseline variables have been identified and accounted for. Difference may be attributable to the fact that the student groups

were different. In order to make a better comparison, randomisation would be helpful. However, removing choice in favour of random allocation to medical school would most likely be unacceptable to UK medical school applicants.

Difficulty in identification of outcome measures

Assuming randomisation was possible, another problem is the decision about what sort of data to use to make a comparison. Medical schools set their own exams so standardisation would be necessary if one wished to make comparisons. Some national exams are being developed; in the UK, for example, the Prescribing Safety Assessment Council (PSA 2015) have set a national exam enabling a direct comparison of this data, but it would measure only prescribing which is a small part of the curriculum.

If one were interested in the idea of teaching method comparison, one would also need to determine the effect of size that would be anticipated to make sure that enough numbers of students were compared. Another possibility could be, comparison of time taken for successful course completion. Some students resit exams or retake parts of the course, but of course medical schools have different criteria for exam resit eligibility and different numbers of exams at different points in the curriculum. Alternatively, course completion rates could be considered which would include the student dropout rates, but these would all be of limited value.

If large enough data numbers were available, though difficult, it would be possible to make comparisons between PBL groups or institutions, but if differences were found, of course causality may be harder to establish. I agree with Norman (2000)

who suggests that although randomised trials are possible and have been undertaken in educational research, they are just not worth the effort involved in doing them. In addition, he suggests that curriculum level interventions, using simple experimental designs such as RCTs' and limiting the manipulation to one variable are doomed to fail. Evidence of this prediction can be found in the large outcome-based, comparative studies and meta-analysis of randomised controlled trials that have been undertaken in PBL which have been largely inconclusive in identifying significant overall differences between PBL and traditional medical schools (Albanese and Mitchell 1993, Vernon and Blake 1993, Neville 2009). Furthermore, they provide little information about what happens in PBL tutorials, so they are not of great help in guiding practice.

Effectiveness of PBL

Reviews of outcomes of problem based learning have failed to demonstrate that students on a PBL curriculum retain more knowledge than those on traditional curricula (Albanese and Mitchell 1993, Vernon and Blake 1993, Neville 2009, Custers 2010). These educational outcome-based studies are however fraught with difficulty. One major difficulty with these studies is the comparison of traditional medical schools with PBL medical schools. Classification of medical schools into these two categories is not straightforward. Some schools claim to be traditional but have small group teaching very similar to PBL. Some claim to be purely PBL but use other didactic teaching methods e.g. lectures. Some schools claim to be 'hybrid' which is probably closer to the reality for all medical schools.

Another issue is that PBL is carried out in such a variety of ways in different schools that one cannot really make a definition of a PBL curriculum. There are in fact so many variations of PBL that Barrows redefined his original PBL method and called it 'authentic Problem Based Learning' or 'aPBL' because he felt that many PBL practices did not reflect his method (Barrows 2000). Another problem with studies designed to address outcomes of interventions in the real world is the issue of external influences. These will have had an effect during the time of the studies because students would have experienced many changes, and an enormous range of factors would have influenced their learning. These changes to the curriculum have not been described and accounted for. Also, these comparative studies lack baseline measurements. It is impossible to know if the students in PBL medical students and those in traditional medical schools started with the same baseline of knowledge or whether the two groups were different in some way due to selection bias of different medical schools. This is not addressed in the comparative studies. Finally, one of the greatest problems to consider is the size of the difference that might be expected. Very large numbers of students would be needed to pick up a small difference.

In summary, Barrows' claim that knowledge decay was a significant problem in the undergraduate medical curriculum is not evidence based and the theory that knowledge retention would be improved through PBL has not been demonstrated in practice. The literature provides descriptions of PBL practice that highlights huge variation, which means many of the comparative studies that have been

undertaken are methodologically flawed in research terms. Difficulty in the definition of PBL practice makes comparative research difficult and unhelpful in relation to improving practice. We have little empirical evidence for effectiveness of PBL, but neither do we have empirical evidence for the learning methods that went before in so called traditional medical schools, or for any other learning method that has historically been used to train doctors.

Decisions about research methods

When considering the research method, I ultimately steered away from the familiar quantitative approach because of the problems outlined above in relation to heterogeneity, difficulty in baseline measures, unpredictable changes, confounding factors and difficulty in identification of suitable outcome measures because they would reduce the robustness of the findings. You can compare apples and oranges if you try hard enough but it does not make either taste any better. My focus was to explore areas for improvement in PBL. I wanted to identify ways in which we could enhance the learning process.

Brainstorming was an area that was often in receipt of criticism from both students and tutors, so this was the area that I selected to explore. Brainstorming is a fundamental part of the learning process in PBL. It is one of the defining features and standard practice for students to start PBL by discussing a case scenario. I was clear that a qualitative approach would be a better way to achieve the level of detail I needed.

The purpose of my research was to find ways to improve PBL tutorials at Norwich Medical School. I wanted to have better understanding of what was happening in PBL tutorials at Norwich Medical School in order to be able to identify ways in which it could be improved, so I decided the best way to do to this was to collect data about what was happening in PBL tutorials.

Preliminary exploration

I initially began my research by attempting to analyse the PBL cases at Norwich Medical School to consider how this affected dialogue, but I found huge variations in the content, style and length of cases we used. It was not obvious as to what was a good case. Next, I observed students using the PBL cases during brainstorming. Again, I found huge variation in what they did, and it varied in different parts of the tutorial. During this initial period of the study, I observed the same PBL case used by two PBL groups and I noticed the conversations that students engaged in surrounding the case appeared to be very different. I also observed that the tutor interventions had a very different 'feel'. I was not able to determine the different aspects, but it was clear that given the same materials, the tutorials felt very different. This made me consider that, although the PBL cases were often criticised, they may not be at the heart of the problem. I reflected that it was possible that the students just found it easier to criticise 'anonymously' written PBL cases rather than their tutor or colleagues. Teaching materials are no doubt of great importance, but I began to consider if improving the written materials alone might not solve the difficulties. I wondered to what extent the tutor could influence the group

discussion. I became more interested in the tutor's role and influence in the PBL tutorial.

I had access to data from the Norwich Medical School students' annual evaluation of PBL tutors and I was aware that some PBL tutors received better feedback from students than others. Certain tutors often tended to be at the top of the table and others at the bottom, but we did not really know why. The data did not provide detailed information about what the tutor did. In a school level analysis, we had tried to identify characteristics of 'good' PBL tutors, but we had tended to focus on the demographics of tutors e.g. how experienced the tutor was, whether the tutor was a doctor or an expert tutor etc. The research literature reflected this type of analysis but was largely inconclusive, with some researchers claiming that the best PBL tutors are probably experienced subject experts, possibly doctors (Davis 1999 , Hendry, Phan et al. 2002), and, others suggesting that differences are not found between tutor types (Kaufman and Holmes 1998). I found evidence from the Norwich Medical School data to show that some of our 'experienced subject expert' tutors were at the bottom of our PBL tutor league table, whilst some 'non-clinical, non-subject expert tutors' were near the top. What was not clear was exactly what those top or bottom rated tutors did.

In 2013 I took over the academic lead for PBL at Norwich Medical School and I found myself in the position of being asked questions by tutors that I had previously asked myself; how can I improve my tutoring skills? One of these questions (for which I did not have a solution) was; how can I help the students be more effective

at brainstorming? I realised I did not really know what 'better brainstorming' should sound like and decided I would have to undertake my own research.

I needed information relevant to our own flavour of PBL that would enable tutors to develop their skills. I decided to explore what happened in the PBL tutorials and recruit PBL groups to take part in an observation study. This is how it became my research field.

Ethical Approval

Students and staff provided consent to take part in the study. They also consented for the findings to be published and to be used for the purposes of education (Appendix 2 and 3). The data has been stored on a password-protected computer. I will retain the original data for five years after completion of the thesis and use it to enhance tutor training. I also intend to submit a research paper for publication in a research journal. I obtained approval from the Research Ethics Committee in the School of Education and Lifelong Learning at the University of East Anglia (Appendix 5) and the permission of the MB BS course director of the undergraduate medical school program.

Study Design

Participant recruitment

I recruited five groups of PBL students; each group had 10 students and one PBL tutor. All students were in Year 2 of the 5 year MBBS course at Norwich Medical School. I observed and recorded one PBL tutorial for each of the groups.

Student recruitment

In order to recruit students to agree to take part in the study, I attended one of the medical students' lectures at the start of the year 2 curriculum where I had the opportunity to speak to the whole cohort of approximately 170 students. I gave a 15-minute presentation to outline the purposes of the study. I advised students that I would be asking for volunteer PBL groups to take part in the study later that year and that their PBL tutor would approach the groups and discuss this with them.

Tutor recruitment

I met the year 2 PBL tutors at the start of the academic year and asked for volunteers to take part in the study. I asked the tutors to discuss the project with their PBL group and to contact me if they and their students would be interested in taking part in the study. Five PBL tutors and the students in their PBL groups volunteered. I visited the interested groups during a PBL session and discussed the project with them. I provided each student and each tutor with an individual consent sheet (Appendix 2) and an information pack (Appendix 3). I asked them to read the information and return the consent form to the tutor. When I received

signed consent forms from the tutors and students that I had approached, I arranged a date to observe and record a PBL session for each group.

Data collection

I observed and audio recorded five PBL tutorials. I recorded four full PBL tutorials and one in which I recorded only brainstorming because the tutor for that group had told the students that I would be recording only the brainstorming. My observation lasted between one hour (brainstorming only) and three hours (full tutorial). I made brief notes on the layout of the room and events that took place.

Audio recording and observation

I used a SONY IC recorder ICD-UX512 with a built in microphone as a recording device. I exported the audio data into a VLC media file.mp3 player on a personal computer. I chose audio recording rather than video recording in order to minimise intrusion into the tutorial as much as possible and to allow observation of the unfolding of real life events without interruption. I was present in the tutorial and operated the recording device. The audio recorder was simple to use, it was small (10cm by 3.5cm) and there were no technical difficulties; the recorder required simply pressing the 'on' switch and placing on a table. It made no noise.

Advantages of audio recording

Audio equipment can be less intrusive than other data capture recording methods. An advantage of audio recording over video recording is the relative anonymity that audio recording can provide. I considered using a video recorder to capture non-verbal communication, however, I felt this would be intrusive and reduce

willingness to consent to take part in the study. I felt anonymity was particularly important to students in deciding about whether to take part in the study and that audio recording would increase my chances of obtaining suitable material.

Limitations of audio recording

Audio recording has limitations; interactions are sometimes non-verbal and in PBL for example, students might nod in agreement or the tutor might look at a student to prompt a response. Verbal interactions might make little sense without this visual input. I was not able to capture this data.

Transcription method

The audio recorder was sensitive and able to pick up the voices in the room, but it did also pick up extraneous noises, for example, the computer fan, rustling of paper and the noise from eating food. In addition, noises external to the room, for example traffic noise and in one case a drill, also affected the quality of the recording. There were 11 voices in the room and people often spoke over each other. Differentiating between students in the group was also sometimes difficult. The tutor was usually possible to identify, and it was generally possible to differentiate between male and female voices. In tutorials where students were working at a round table, they were equidistant from the microphone, which meant all voices were similarly audible. In some rooms, the table was rectangular which resulted in some students being closer to the microphones than others and their voices were consequently louder.

Participants

My decision to use year 2 students and tutors was based on several pragmatic factors that included access to PBL sessions. I had a close working relationship with the PBL tutors and a good understanding of the year 2 curriculum. From a practical point of view, the students in Year 2 were at the university site for most of the year.

The students in year 2 had some prior experience of PBL from being a member of a PBL group in the first year of study. I wanted students to have the opportunity to settle into their groups and in addition, I did not want to record sessions just prior to exams. For these reasons the recordings took place early in the second semester. At that time, year 2 were studying one of three rotations; cardiology, respiratory or dermatology/haematology.

Selecting to study a single year group is one of the factors that mean the results of this study are not directly applicable to other PBL groups in other years or other institutions. Furthermore, I have studied well-established groups. Newly formed PBL groups may have different communication issues that are not picked up in this research project.

Decisions about data analysis

My primary source of data was audio recordings of five PBL tutorials. I considered how to interpret my data.

At the start of the study, my focus was on exploring the use of the PBL written cases and how the students and the tutor used these during brainstorming. The recordings contained some informal discussion from the students and the tutors in

relation to how well they felt the scenarios were written and how well they felt their tutorials were going. The students were critical about the content of the scenario, but of course, with the tutor in the room, they were unlikely to be critical of him.

I had asked consent for volunteers to take part in an interview and I undertook interviews with the five tutors and five students individually. I considered sharing my data and the transcriptions with the tutors and students to explore their perspective to gain further insight into what was happening in the tutorials. The logistics of this were difficult however and, having attempted this with one group, I felt I gained little from the exercise. Neither the tutor nor the students were willing or able to reflect in much depth on the effectiveness or ineffectiveness of the tutorial process. In hindsight, maybe my position as head of year 2 and head of PBL was inhibitory.

I looked for analytical methods that would enable me to analyse the tutorial data further. I considered use of action research. The fundamental aim of action research is to improve practice rather than to produce knowledge and as this was my ultimate aim, the method seemed appropriate (Elliot 1991). Action research involves discussion and collaboration with participants usually on more than one occasion, often described as research cycles. I considered how I would manage this method and began planning but I realised quickly that I did not have a cohort of committed participants who would be willing to commit the amount of time needed for this sort of process. In addition, as I continued to listen to the

transcripts and talked informally to tutors and students, it began to emerge that tutors and students were unaware of the dialogue patterns in the PBL tutorials.

I became more interested in exploring the dialogue that was occurring in the PBL tutorials and particularly began to focus on identifying factors that promoted effective discussion. I decided to explore the dialogue in detail and focus on tutor interventions. There are several ways of exploring dialogue. I identified four methods that I felt could be appropriate for my data set: discourse analysis, critical discourse analysis, Foucauldian discourse analysis and conversation analysis (Wooffitt 2005).

Discourse analysis is a broad term that can encompass several analytical methods. It is a method of analysing several different types of data including both written and spoken language. The aim of discourse analysis is to enable exploration of language to determine socio-psychological characteristics that can help give insight into how a society is organised. Whilst this was interesting, it would not necessarily serve my purpose of improving communication in PBL (Woofitt 2005).

Critical discourse analysis is a branch of discourse analysis in which linguistic and discursive methods are used to analyse dialogue in many contexts for example, newspapers and radio broadcasts alongside interviews and conversations. It can be used to explore underlying political or ideological concepts, for example, inequality in society. Again, this was interesting but not of practical value.

Foucauldian discourse analysis is another branch of discourse analysis that focuses primarily on the structure, patterns and constructions of dialogue as a representation of power relationships. I was interested in this and decided to consider the power relationship in my analysis, but I did not feel it would serve my purpose of providing guidance for tutors.

Conversation analysis is a more specific term that describes the analysis of ordinary conversation. It focuses mainly on the organisation of interaction and consequences. I ultimately chose this as the best way of analysing my data. I now give a detailed description of this method.

Aim of analysis:

The aim of the analysis was to

1) Consider the theoretical framework of PBL and explore enablers and barriers to effective dialogue,
2) Consider the learning environment of the PBL tutorial, particularly brainstorming, and identify ways in which to maximise the learning opportunities
3) Determine how this knowledge can be used to facilitate effective dialogue to take place between learners in PBL.

Application of findings:

Develop best practice guidelines for PBL, with specific reference to effective expressive strategies.

Conversation analysis

Conversation analysis is an approach to the study of social interaction and how people may be seen to demonstrate an understanding of social rules through analysis of the organization of 'conversation', or 'talk-in-interaction' (Ten Have 1986). Conversation analysis was advanced by Schegloff and Sacks (Schegloff and Sacks 1973) following the ethno-methodological work of Garfinkel (Garfinkel 1967). Ethnomethodology is a style of analysis and can be considered as a branch of sociology which explores the development, structure, and functioning of human society. The method is usually attributed to Emile Durkheim (1858-1917). Ethnomethodology seeks to determine and analyse the cognitive models or methods which participants employ in ordinary social situations (Garfinkel 1967). A full discussion of the relationship of conversation analysis to ethnomethodology and sociology is beyond the scope of this research project.

Conversation analysis gained momentum with the development of a systematic method of data analysis and coding (Jefferson 1985). Interest was renewed in the 1980s after publication of Harvey Sacks lecture notes subsequent to his untimely death (Sacks 1994). The fundamental idea supporting conversation analysis research is that every day mundane talk is essentially quite well-ordered with sequences tending to follow set patterns and unwritten rules, which are often unrecognised by partakers (Schegloff and Sacks 1973). To enable the patterns to become explicit requires analysis of conversations at a micro level. It usually involves very detailed transcription and micro-inspection of audio recordings of live

interaction. It is concerned with 'naturally occurring' conversations rather than experimental conditions.

Many conversation analysis practitioners do not follow a pattern that would be recognised by social scientists or empirical researchers in the writing up of a research report (Ten Have 1986). Reports often do not contain a literature review or detailed discussion of the methodological issues or the theoretical basis of the research strategy. Some do not include details about sample selection or coding procedures. My research is related to education and the setting is a medical school. Conversation analysis is an unusual research method for doctors so, I have chosen to present the methodology in detail and in a way that is likely to be more familiar to medical educators for whom I hope it will ultimately have relevance.

Criticism levelled at conversation analysis, focusing on its limitations, highlights the fact that it tends more towards a behaviourist model of analysis without providing the depth of understanding that can be gained from other sociological and ethno-methodological research methods (Atkinson 1988). The information it provides is limited to speech, however, it includes more than words alone; Gail Jefferson (1938-2008) developed a notation for transcription which includes fine detail including among other things, codes for interruptions and laughter (Jefferson 1985).

Though conversation analysis cannot provide information about every aspect of PBL behaviour, speech is the major communicative method used in tutorials so, this is a good place to begin the research process to enable better understanding.

The key assumption underlying this type of analysis is that although we may perceive each conversation we have as unique and individual, conversation is actually a quite well ordered process. Ordinary conversation has been described using conversation analysis so that it is possible to recognise a pattern in many every day conversations. The analysis of this ordinary conversation shows usually only one person speaks at a time and there are minimal breaks between speakers. It is usual for a pattern of turn-taking to occur in which the person speaking nominates another person, and that person will then usually take over the conversation. If nobody is selected, any person can self-select at a 'transition relevant place' (Schegloff and Sacks 1973). Through repeated exposure and familiarity with conversational norms, most people follow the usually unwritten rules about when to speak.

Institutional conversation

Conversations that take place in institutions can differ from everyday social conversations (Drew and Heritage 1992, Koester 2004). In an institution, different goals may be desirable to those of a social setting where the goal may be bonding and friendship. Differences between ordinary conversation and institutional conversations can also be found in the use of vocabulary; a specific lexis is often used inside an institution that would be unusual outside of the institution. Institutions can also have precise and distinctive turn-taking rules. For example, a courtroom has a set pattern to the dialogue that must be followed to obey the rule of law. Dialogue in an institution is sometimes predetermined as in a church service

such as a christening or a wedding when certain phrases are used. There may also be restrictions on what sort of verbal contributions are allowed, for example, the congregation in a church is expected to remain silent at certain times in the service, but at others, to produce formulaic responses, for instance 'Amen'. Professional interactions are sometimes structured in a very specific way and asymmetry in the dialogue often reflects power relationships. This can be seen in the courtroom, the church, and indeed in the classroom.

Classroom discourse structure

The classroom is a specific type of institution. The conversation in a classroom often has a recognisable discourse pattern. This has been described by (Mehan 1979) as the Initiation, Response, Evaluation (IRE) structure. In this IRE classroom discourse, the initiation is usually directed by the teacher and often takes the form of a question. It is also usually the role of the teacher to select the next speaker. This can be done in a variety of ways: by name, by gesture, by inviting students to raise hands to bid for a turn, or by inviting a group response whereby all pupils are expected to respond in unison (McHoul 1978). Once a reply has been delivered by a student, the evaluation subsequent to that is invariably delivered by the teacher, unless the teacher offers the turn to another student (Wooffitt 2005).

This type of classroom discourse often has pre-set answers, for instance, there is only one answer to the question e.g. 'What is the capital of France?' 'Paris'. This is referred to as a recitation. Most children recognise this pattern and know that, even if they know the answer, they must only answer if asked to do so by the

teacher. In the IRE classroom discourse, the teacher is in charge and is the holder of knowledge and power. The teacher determines who can and can't talk and the teacher decides if the answer is correct. It is an outdated pattern, but it is still found in educational settings including university and medical school.

Cooperative learning discourse structure and theoretical perspective

At the same time that Barrows was developing his new model for undergraduate medical school teaching, changes to this IRE classroom discourse were also beginning to emerge. Classrooms were beginning to be reorganised and desks that had been arranged in rows facing the teacher were now arranged in small groups facing each other. Different discourse structures were promoted and 'cooperative learning' was described (Slavin 1985). In this model, the teacher facilitates the students to engage in dialogue with one another directly. The students are enabled to learn from others who may be just a little more advanced than they are themselves in the 'zone of proximal development' (Vygotsky 1978). The Vygotskian perspective of scaffolding suggested that students could achieve more when supported than they could alone. The Piagetian perspective describes that learning in this way, in small groups, can result from the creation of cognitive conflict in which the learner identifies a dissonance between their existing understanding and explanations given by peers, thus creating a need to fill this gap.

Research on effectiveness of cooperative learning is extensive and many studies have compared outcome measures (Qin 1995) which show positive results for

knowledge gain (Slavin 1985). Numbers of school children are of course much larger than numbers of medical students and, there is the availability of standardised tests in general education that do not exist in the undergraduate medical curriculum in the UK.

Elaboration

More recently, research exploration of the dialogue that occurs between students has been carried out and this has aided identification of linguistic elements that appear to enable effective learning between students. Studies in which the interactions of students are explored in detail highlight that 'elaboration,' in which students explain their thinking, appears to be of particular importance in the learning and understanding of concepts (Webb 2009). It is clear that the extent to which students benefit from working in small groups depends on the quality of interaction between students within the group. Webb defines elaboration to include:

- Verbalising conceptual understanding
- Elaboration of conflict (identifying conflicting information)
- Co-construction of understanding
- Answering/ asking relevant questions

Webb concludes that there is growing knowledge about the types of student interaction that aid learning, but much less is known about how the tutor can foster these types of interaction.

PBL tutorials share many features with cooperative learning tutorials, in that students talk directly to one another, not always to the tutor, and much of the research in cooperative learning can be applied to the PBL classroom. However in most cooperative learning classrooms, the teacher remains the subject expert, whereas in PBL tutorials this is not necessarily the case.

The tutor's role in fostering dialogue between students in PBL

Multiple dimensions exist in the teacher's role in fostering collaborative learning dialogue. In PBL, students acquire their knowledge from many learning opportunities alongside independent study. They bring their knowledge to the PBL tutorial and learn from each other rather than the tutor. In a PBL tutorial, it is usual for a student to be nominated as a 'chair' for each session. In this role, the student is given responsibility to coordinate the discussion. In PBL, the tutor therefore may not hold the same power over dialogue as a teacher in a school classroom or a cooperative learning classroom

What has been less researched is what tutors actually do and say in tutorials to promote effective discussion. To date, there has been little research of linguistic elements that could enhance effective learning and effective questioning techniques in the PBL setting.

In this research, I analyse the dialogue in the PBL classroom, focusing on identification of questioning techniques and linguistic elements that could be used by the tutor to promote elaborative dialogue.

Data analysis process

As I became familiar with the corpus, I began to listen to conversation fragments in great detail. My analysis was iterative and evolved as I listened to repeated segments of the audio recordings and read the transcripts. My analysis was influenced by; 'Doing Conversation Analysis; a Practical Guide' (Ten Have 2007), 'Conversational Analysis: An Approach to the Study of Social Action as Sense Making Practices' (Pomerantz and Fehr 1997), 'The Language of Work' (Koester 2004) and 'Conversational Analysis: A Handbook of Social Interaction' (Drew and Heritage 1992). Through this repeated listening, I made observations of patterns of discourse. I focused my analysis on the relationship of the tutor questions to the student answers and attempted to identify types of questions that resulted in elaborative talk by students (Webb 2009). An 'idealised version' of conversation analysis has been produced by (Ten Have 1986) and I used this as a framework in the early stages.

Analysis of episodes

I used a professional transcriber to make a full transcription of the audio recording of the whole tutorial as transcription of 11 voices in a room was challenging.

a) I listened to the audio recording over and over repeatedly to become familiar with the data. I began to identify patterns and also differences between the different tutorial dialogues. Whilst looking at the transcripts I replayed the audio data. To capture as much detail as possible at certain points, I slowed down the audio recording and added further details that were revealed.

b) I identified tutorial extracts in which the student responses were 'elaborate' and analysed the tutor interventions that had preceded the responses. I identified student dialogue episodes that were non-elaborative and considered the tutor intervention that preceded the dialogue. I considered what was missing as well as what the tutor actually did.

c) I identified points of interest and 'odd' occurrences; laughter, whistling and an 'Aha' moment (Kounios and Beeman 2009).

d) I used CA dialogue type coding using a version of the Jefferson convention (Jefferson 1985, Wooffitt 2005).

Interpretation

I used tacit knowledge of the Norwich Medical School, my experience of working as a PBL tutor, my notes and, recollections of what happened during the tutorials, to make sense of the student-tutor interaction and the student dialogue. I paid attention to student-student and student-tutor dialogue patterns and focused specifically on tutor questions that preceded episodes of 'elaborate' or 'non-elaborative' responses from students. I developed a coding framework to describe tutor questions and interventions

Development of coding framework of tutor interventions

Questions can be categorised in many ways. A very simple classification places questions into two broad categories: 'open' or 'closed'. A closed question may be answered with a single word or a short phrase, for example, 'did you come by train?' whereas an open question will require a more extensive answer, for

example, ‘how was your journey?’ Both have their uses; a closed question can provide precise information to confirm an idea or clarify something, an open question can be useful in providing a greater variety of information and supplementary detail.

Another classification system is Bloom’s taxonomy which is a hierarchical arrangement of question types often used to design questions for examinations (Bloom, Engelhart et al. 1956). In this classification, a low order question might be simple recall of fact, for example, ‘what class of drug is Rivaroxaban?’ A higher order question might involve more detailed knowledge or comparison, for example, ‘what are the advantages and disadvantages of Rivaroxaban compared to Warfarin?’ A very high order question might involve judgement, for example, a student might be asked to discuss treatment for a patient with atrial fibrillation and outline whether Warfarin or Rivaroxaban would be the best treatment option. This sort of hierarchical questioning technique can be used in the classroom, working from low to high order questions or the other way round depending on the anticipated knowledge of the students and the responses obtained.

Another classroom questioning technique is the ‘Socratic Method’ developed from the work of Socrates, a Greek Philosopher who lived in Athens around 400BC. The ‘Socratic method’, first described by Plato in the *Socratic Dialogues* is considered to be one of Socrates’ most important contributions to Western thought (Plato 360 B.C.). Socratic questioning is the art of asking questions to probe students thinking. It is used in many disciplines including education, psychology and law and can be

used for a variety of purposes: to explore complex ideas, to open up issues, to uncover assumptions and to discover what is known and not known about a topic. Six types of Socratic question have been described (Paul and Elder 1997); 1. Questions for clarification: 'Why do you say that?' 2. Questions that probe assumptions: 'Can you verify that assumption?' 3. Questions that probe reasons and evidence: 'What would be an example?' 4. Questions about viewpoints and perspectives: 'What would be an alternative?' 5. Questions that probe implications and consequences: 'How does that affect?' 6. Questions about the question: 'Why is that an important question?'

Use of the Socratic Method of questioning requires some training and practice because it is not easy or intuitive to all. A Socratic questioner should; keep the discussion focused and intellectually responsible, stimulate the discussion with probing questions, periodically summarize what has and what has not been dealt with and/or resolved and draw as many students as possible into the discussion (Paul and Elder 1997).

Medical Students are taught questioning techniques in the undergraduate curriculum. The main model taught in medicine is the Calgary Cambridge model. Most UK trained medical graduates will be familiar with this model. Qualified doctors undergo further training in communication skills. General Practitioners are trained and assessed in their ability to communicate effectively with patients. Techniques taught include the use of open and closed questions, exploratory questions, use of body language to encourage patients to provide more details, use

of clarifying questions, use of summarising statements and statements to check for understanding. I incorporated these classifications into an iterative coding framework.

Tutor intervention coding

AOQ	Answering own question
AWM	Agree with me questions/statements
CHAL	Challenge questions
CLOSED	A question with a yes or no answer
DOUB	Double/multiple questions
EXQ	Extension questions
INST	Instructions
INTER	Interrupting
LIST	Listening and responding to student comments.
LONG	Long question
MEO	Missed elaboration opportunity
MIN	Minimal response
NWAIT	Not waiting for an answer
NLIST	Not listening or responding to student comments.
OPEN	Open-ended questions/exploratory
ORG	Organising questions

RMM	Read my mind questions
SHORT	Short question
SPEC	Specific question
SUM	Summarising
VAG	Vague, unclear questions/rambling, long statements
WAIT	Waiting for an answer to give students time to think

Student response coding

ELAB	Elaborative Dialogue containing one or more of;
	Asking relevant specific questions based on existing knowledge
	Answering relevant specific questions based on existing knowledge
	Co-construction of knowledge, adding knowledge
	Identifying conflicting information based on own knowledge
	Verbalising conceptual understanding
NELAB	Non-elaborative dialogue in general
READ	Reading scenario

Transcription notation

T = tutor talking

S = student talking

(.)	A full stop inside brackets denotes a micro pause, a notable pause, but of no significant length.
(0.2)	A number inside brackets denotes a timed pause. This is a pause long enough to time and subsequently show in transcription.
[	Square brackets denote a point where overlapping speech occurs.
> <	Arrows surrounding talk like these show that the pace of the speech has quickened.
< >	Arrows in this direction show that the pace of the speech has slowed down.
(yes)	Where there is a word in brackets it denotes a guess at the word.
( )	Where there is space between brackets denotes that the words spoken here were too unclear to transcribe.
(( ))	Where double brackets appear with a description inserted, it denotes some contextual information where no symbol of representation was available.

Under	When a word or part of a word is underlined, it denotes a raise in volume or emphasis.
↑	When an upward arrow appears, it means there is a rise in intonation.
↓	When a downward arrow appears, it means there is a drop in intonation.
CAPITALS	Where capital letters appear it denotes that something was said loudly or shouted.
(h)	Humour when a bracketed 'h' appears indicates there was laughter within the talk.
=	The equal sign represents latched speech, a continuation of talk.
::	Colons appear to represent elongated speech i.e. a stretched sound.
∘ ∘	Quiet talk

Reliability and validity

Recording of naturally occurring data are conversation analyses' basic data. The transcript and the analysis of the data is explored and made to represent, as closely as possible, the verbal dialogue. Transcribing and annotation cannot represent speech exactly the way it was delivered however, and there will inevitably be some misinterpretation. There is also a chance that things could be misheard or

misunderstood. Some confusion may also occur due to the lack of non-verbal communication cues.

The selection of the data to be recorded and the analysis are subject to researcher bias. An important methodological consideration in undertaking conversation analysis is that the analysis be fitting of the phenomena to be explored. I have presented segments of the brainstorming parts of the tutorials that were of relevance to my research question; what communicative strategies can be used by tutors to enhance elaborative dialogue between learners in Problem Based Learning tutorials? I present these segments in full alongside my notes and code.

Sometimes conversation analysts make the primary data available for analysis by the reader either as video or audio recordings alongside their own analysis. This is a way of improving validity and reliability. I was keen to provide anonymity for the participants and I did not obtain consent for the data to be shared in this way.

Conversation analysis does not usually involve use of interviews. I had initially considered the use of interview data alongside the conversation analysis, but it became apparent that neither the tutors nor the students were able to shed light on linguistic techniques of effective questioning. They were unaware of dialogue patterns and question types that they used, so ultimately I did not use the interview data in my analysis.

Reflexivity

In undertaking the research I was aware of my many role in the medical school; head of PBL, head of year 2, a PBL tutor and a doctor trained in a traditional medical school. I was conscious this would influence the behaviour of the students and tutors.

As head of PBL, I wanted PBL to work as well as possible. Issues and concerns about PBL were reported to me to sort out, however, tutors might not have been willing to report concerns to me as they may have been mindful that in the future, they might need me to write a reference about their effectiveness as a PBL tutor when they applied for future jobs. Students would also have been likely to see me in a position of authority because when there were problems in PBL groups, the tutors would report their concerns to me and I would sometimes sit in with tutors in groups to support them. Sitting in as an observer I was not unnoticed.

To complicate matters further, I was Head of Year 2 in the Norwich Medical School. This may have made the students concerned about my observation of their PBL session. They may have felt anxious to be seen to be behaving in ways that are deemed acceptable in PBL. My presence in the room no doubt impacted on the dialogue that took place in the tutorials. As head of Year 2, I was also in a position of power as disciplinary issues were reported to the head of year in the first instance.

I was also mindful of the influence of my own educational experiences on my decisions in relation to the undertaking of the research. As a doctor I had been

trained in a traditional medical school. Though my training had been successful in many ways, it was not always fun or interesting. I had sat for many hours in lecture theatres taking notes which I learned and subsequently regurgitated in examinations. On taking up my post in the Norwich Medical School I was excited to learn about a 'new' learning method - and slightly disappointed that it was not quite as I had hoped. I needed to come to terms with this.

As a researcher, I needed to identify something new and also decide how to make sense of the copious data I had collected, but overall my most important aim was to be able to identify ways in which we could improve PBL. This was made more important shortly after starting the research study when I was offered the role as Head of PBL. The student evaluation of the PBL curriculum then became my responsibility and increased the pressure to improve the quality. In this role I also became responsible for the recruitment and line management of PBL tutors. This may have made the tutors somewhat worried about my observation of their session.

Altogether, my position as a researcher within my own institution was complicated and required some careful consideration when undertaking the study and interpreting the data. I recognise that to some extent the tutorial dialogue patterns were affected by my observation and audiotaping of the sessions.

On a personal level, as a PBL tutor I wanted to work out how to facilitate the students' learning more effectively. I was not satisfied with the quality of my

tutorials. I wanted to hear light bulb moments in the PBL classroom. I wanted to consider ways in which I could improve - but realised I did not have tools for reflection.

I went through a series of emotions in trying to balance all these roles. The insider outsider conundrum is far from clear cut (Hellawell 2006). In many ways I felt I was doing 'insider research' but, I was not a PBL medical student nor was I researching my own student group so in many ways I also felt an outsider.

CHAPTER 4 Data Analysis

Tutorial Group 1

1126.		**Dialogue**	**Interpretation**	**Code**	
1127.	T	OK I think we should get going again let's have a volunteer (NAME) would you read the scenario for us	Tutor asks the group to start reading the scenario. The tutor takes charge. The student chair is not in charge.	INST	
1128.	s	Um ( ) Mary Philips is a 68 year old, um is 68 years old and, over the last few months (0,1) has had several blackouts. She feels dizzy and unwell.	A student begins to read the scenario.	READ	

	sss	She thinks her heart may have raced a bit…a bit beforehand but, that it's…ki.. ( ) it says… [	A student interrupts	INT	
1129.	S	[The grammar, the grammar doesn't make sense ((mumbling))	Students complain about the scenario.	NELAB	
1130.	S S S S	°Just go to the top° You're at the top= It that the same thing= No ((Laughing))	The student reading moves the display and scrolls up too far.	NELAB	

1131.	S S	What? Go up (name) (0.5)	The student can't find the scenario.		
1132.	T	That's the second one isn't it?	The student is confused about whether she has found the right scenario.	NELAB	
1133.	S S S	There we go No (.) scroll down That's Bi Bi[	The students are looking for the beginning of the scenario again on the projector.	NELAB	
1134.	T S	[Sorry, you've gone back a week you've gone back to week= =Oh no	TIME: 1.33.06.5 The students scroll back too far to the wrong scenario.	NELAB	

1135.	S S S	We don't want to do that do you= Yes Thank you	Students support each other. A student identifies that they have found the correct scenario.	NELAB	
1136.	T	There you are that's better (0.2) , Yes (0.2), OK↓	They find the correct scenario again. Tutor reassuring students but students are in charge of finding the learning material.	GEN	
1137.	S	Thank you Mary Philips is a, is 68 years old and over the last few months has had several blackouts. She feels dizzy and unwell. She thinks her heart may race a bit beforehand but that it's the last thing that she remembers.	A student reads the scenario (The purpose of the scenario is not clear; is it to stimulate students to want to learn, help students develop clinical reasoning skills, activate prior	READ	

		Although it occurs more when she, when standing up or possibly when looking up, it also occurs when she is sitting… When she comes around she feels tired but the next, next day is fine. After one episode she has bruised herself all down one side her husband says that she goes very pale but does she does not jerk her limb nor is she incontinent. Mary is taking 100mg of Atena, Atenolol for her blood pressure. She weighs 50kg her husband asks her GP if she should drive. Mr Philips is referred to the hospital and after a	knowledge and serve as a guide to the curriculum or be a focus to trigger discussion?) From the discussion it appears the tutor and the students interpret the purpose as guide to the curriculum- but they also have learning outcomes and lectures as a guide to the curriculum. The student stumbles on the word Atenolol which is a clue that it is probably unfamiliar.		

		number of investigations has, has a special kind of pace maker fitted as well as being prescribed some other pills to thin her blood. Her cardiologist says she an abnormal heart rate. She feels very frightened about the whole business and when she gets home she visits the GP to ask about flying			
1138.	S T	Mmm ((Laughter)) Are there, are there an:y↑, anything there anyone doesn't understand?' They'd like me to cla::rify before we go	The tutor takes the floor. The tutor leads the questioning. The tutor asks 3 questions at once – leaving no time for	VAG	

	s T S	through it bit by bit. It's very-er >reasonably< straight forward isn't it↓,? erm↑=… = Ok↓, ['No terminology or issues there↓ (NAME) do you want to starts us off? [yeh	students to answer before saying its 'reasonably straight forward'.	CLOSED NLIS NW AWM INST	
1139.	S	Mary Philips is a 68 year old and over the last few months has had several blackouts	A student reads the scenario again	READ	
1140.	T	What, wh::at do you make of that sentence and is there anything you	Does the tutor mean 'know' in terms of identification of medical	VAG	

		need t'… what do you think you (.) need to know (.) to help you understand it a bit better?	knowledge or study topics or 'know' about the patient? The question is not clear. There is no time for the students to answer	NW DOUB	
1141.	S	She's had quite a few blackouts it's not just one single episode	A student makes an observation about the medical history.	ELAB	
1142.	T	OK↓, do you unders-, what, what, what, what do you understand by blackout?	A good question to get student thinking and a discussion going	OPEN	
1143.	S	It's when um, there's no, um warning? (0.5) Well, there are two types; there's the…blackout when you don't	A student tries to explain his understanding of blackouts. He claims to know two types.	ELAB	

		remember anything or there's a simple faint↑?			
1144.	T S Yeh T	Yes, in other words there's more than one sort↓, of blackout but (.) what's the crucial thing with the blackout that would dis, differentiate it from say, (.) a dizzy spell?	The tutor stops the discussion. He does not offer a turn to any other student. The tutor does not ask the student to explain his answer in more detail. He does not ask for any other students' knowledge of blackouts. The tutor asks another question (less open), implying there is one important thing to know.	NW AOQ DOUB	

1145.	S	erm… after it you can [absolutely	A student begins to answer but is interrupted	NELAB	
1146.	S	[Memory loss	Another student answers the question	NELAB	
1147.	s T S	you feel (accurate)… you feel absolutely fine↑? (and can get up) yeh and= =and normally when you fall you have no warning and you end up with bruises and	Students talk over each other expressing ideas. The tutor tries to get control by talking again. He does not ask the students to repeat what they have said or ask them to explain what they mean in more detail.	ELAB INTER ELAB	

1148.	T s T s T s	I, I guess what I'm trying to get from you is there's some implication of loss of consciousness? Well ((mumbling)) It isn't just that you, you feel a bit peculiar (.) as if you're going to pass out some (times) yeh yeh so, do you feel you need to know <u>more</u>e about what causes blackouts and (0.2) because there are >possibly lots< of ca:auses of them? Is that , is that fair comment?	The tutor takes back control of the discussion and provides the answer. The tutor does not ask the students for their understanding of consciousness. He does not give the students time to think, The tutor has explained his thoughts about the definition of blackouts – the students have not. The tutor has not found out what the students know	AOQ AOQ DOUB	

		Yeh		AWM	
1149.		Yes	Students agree with the tutor	NELAB	
1150.	T	Her age anything there? (2)	Unclear purpose of question	VAG	
1151.	S	Old		NELAB	
1152.	T	Yes, so it's presumably something related to aging and - some form of degenerative procedure >you'd have thought< but we can't be sure. Not a lot else in that sentence is there↓ (0.5) What, what about the next one↓, (student name)?	TIME 1.36.06.2 The tutor explains his thoughts about the scenario. Not clear what he means in terms of not a lot in that sentence.	AOQ DOUB VAG	

1153.	S	She feels dizzy and unwell she thinks that her heart may race a bit beforehand but that is the last thing she remembers. (1) So, (0.5) she does get the dizziness before, (0.5) perhaps she gets tachycardic?	A student reads a bit more of the scenario again then tries to interpret it.	READ	
1154.	T	So she gets some sort of <u>war</u>ning doesn't she↓,	The tutor expresses his thoughts. He does not check other students understanding of the medical term tachycardic.	CLOSED	
1155.	S	[Yes	Students agree with the tutor	NELAB	
1156.	T	[She feels dizzy and she feels quite unwell with it and	The tutor's dialogue is not clear but he asks an open question at	VAG	

		then she thinks that she's got some sort of not (0.5) all we can say is ( ). What do you think the heart racing means? (1)	the end of a poorly constructed statement.	OPEN	
1157.	S	Palpitations?=	A student suggests an answer. The tutor does not check the other students' understanding of the medical term used.	NELAB	
1158.	T	=Yes↓, I think so↓, there's many many ways of describing it isn't there↓? It's one of those symptoms that we don't really have a clear view of what patients mean by it. It just means something different about the heart. It	The tutor answers his own question. He uses questions tags. He summarises what they (he!) has been talking about.	MEO CLOSED AOQ CLOSED	

		seems to be either going faster or irregular or doing something strange doesn't it↓. So, we've got some symptoms there haven't we↓, dizziness feeling unwell and we've got, we've got palpitations↓		SUM	
1159.	S	And she can't remember it either=	TIME: 1.37.00.1	ELAB	
1160.	T	=She can't [?]	Students talk over each other - the tutor can't hear what is being said.	NW	
1161.	S T	[The actual( )= [=yep↓	The tutor interrupts the student who is trying to explain his thinking (possibly to regain	NW INTER	

	S	[Yes	control as more than one student is talking).		
1162.	T	[Yes so that implies that she does pass out doesn't it↓,	The tutor offers an explanation. The tutor uses another question tag.	SUM CLOSED	
1163.	S	Yes=	The students agree with the tutor.	NELAB	
1164.	T	=Ok so, so far we've got (0.2) thoughts about what causes blackouts and what sort of symptoms people might have before they have a blackout↓ … er that would lead us to think that there was	The tutor summarises again what has already been said and then explains his thinking a bit further.	SUM INST	

		some sort of ( ) perhaps a heart problem? (Student name) next bit…			
1165.	S	Um although it occurs more when standing and possibly when looking up it also occurs when she's sitting. Um so it's not just postural hypotension if it occurs when she is standing up.	A student explains his thoughts and uses medical terminology 'postural hypotension'. the tutor does not check understanding	ELAB	
1166.	T S T	Yes I'd be[[So its [I agree- what about this looking up? What do you think? Does that sound cardiac to you?	The tutor and another student start to reply and their speech overlaps. The student defers to the tutor and stops talking. Three questions	INTER DOUB	

				CLOSED	
1167.	S	Vertebrobasilar insufficiency?=	Medical lexis.	ELAB	
1168.	T	=Yes, it does doesn't it↓. It's more like we've talked about with strokes and things. Doesn't it, it makes you think something is impairing the circulation to the brain maybe? And it's maybe to do with posture so there's a few sort of suggestions there maybe we're on the wrong lines. Does it have to be some sort of arrhythmia beca[use that's…	The tutor does not ask the student to explain the meaning of vertebrobasilar insufficiency. The tutor does not check if other students know what vertebrobasilar insufficiency means.	MEO SUM CLOSED DOUB VAG AOQ	

1169.	S	[Other causes [of[( )=			
1170.	T	=[Absolutely ↓other causes of blackout ↓back again, yes, but as you say, it implies that >whether you take it as true<, you should find out the circumstances under which the blackout occurs doesn't it. ↓ (student name)	The tutor interrupts the student who is trying to explain his thinking, The student defers to the tutor and stops talking. The tutor explains his thinking and uses a question tag	INTER VAG CLOSED AWM	
1171.	S	Um, 'when she comes round she feels tired the next day she's fine. Keep going?		READ	

1172.	T	Yes yes I think so↓ 'cos there's not a lot there is there↓ is there↓. I think it's important though (.) it's something (student name) brought up how people feel after a blackout is a very important question because that might give you clues as to the cause but, in her case >she's 68< it's not surprising that she feels a bit tired is it but it doesn't help us much does it↓. Keep going	The tutor refers back to something a student previously stated. He explains his thinking again. He does not ask for any student's thoughts. He uses question tags. He directs the tutorial and asks the students to read more of the scenario (again)	INST AWM VAG INST	
1173.	S	'After one episode she's bruised herself all down one side' um, (2) um	Students do what is asked and read the scenario again.	READ	

	S	I, I suppose [			
1174.	T	[What, what do you think would have to ha… happened (.) for her to get extensive bruising?	The tutor picks up on a student's point and asks an open extension question.	INTER OPEN EXT	
1175.	S	Um, she's obviously em, that might suggest that she hasn't tried to protect herself when she fell?	A student suggests an answer. The tutor takes the first student's reply and evaluates it and does not leave time for further replies	ELAB	
1176.	T	Yes, in other words it's come on pretty much without warning hasn't it↓.	The tutor does not ask the student to explain her thinking further. The tutor does not ask any other students to contribute. The tutor rewords the student's	SUM NW AOQ	

			answer and answers his own question. He uses a question tag.		

Tutorial Group 2

	S	Yes, scenario two, um, June Salter is a 55-year-old retired account married to John. June was out shopping with her husband in the local superstore when she collapsed unconscious. The store manager had recently trained staff in resuscitation and installed defibrillators. A member of the staff was able to successfully resuscitate and defibrillate June. In the ambulance, June had an episode of ventricular fibrillation treated by the paramedics. In hospital, investigations showed she had suffered a large anterior myocardial infarction and June is given Thrombolysis. Over the next hour in the coronary care unit, June was unwell	Again the purpose of the scenario is not clear; is it to stimulate students to want to learn, help students develop clinical reasoning skills, activate prior knowledge, serve as a guide to the curriculum or be a focus to trigger discussion?	READ	

		and with her heart-rate fluctuating between sinus and ventricular tachycardia and a brief episode of asystole. Her plasma potassium was raised 7 mmol per litre. June became unconscious. Her blood pressure fell and the doctors discussed her resuscitation status with John. (2) So if we go back to scenario[one	There are a number of medical terms in the scenario that may not be familiar to medical students in year 2 of their training		

579.	S	[Is that it?	TIME: 1.31.49.4		
580.	SSSS	No, there a paragraph= =There's a bit 'mumbling' Is there?	A bit of the scenario is missing , some students have it others do not	NELAB	
581.	S S	Mmm Is this last week's one?	One student thinks the scenario might be from the last week. Interesting that they are not sure	NELAB	
582.	S	Er			
583.	S	I've got a bit more			
584.	S	You've got more have you?	Some students have another paragraph	NELAB	

585.	SS All talking	Guys (---)	Students talk over each other in a relaxed and informal way		
586.	S	Do you want [	Students decide what to do	NELAB	
587.	S	[Shall I read it out?	A student offers to read the extra bit. The students are in charge and decide	NELAB	
588.	S S	Yes (mumbling)		NELAB	
589.	S	It says June died later that day and the staff explained (nice and happy) the staff explained to John that she would need a post-mortem because it was an unexpected sudden death. John found	Part of the scenario was missing – a student reads it from the printed version he had brought	READ	

		it impossible to take in what was happening. He found the idea of a post-mortem gave him a whole mixture of feelings as he wanted to know what happened but found the idea of a post-mortem repulsive			
590.	S	So we hadn't had that last bit…	TIME: 1.32.29.5 Students confused about why they had not got the whole scenario		
591.	S	Mm			
592.	S	So shall we brainstorm the first scenario? Or the second? Or do them all together?	The students decide how to run the brainstorming session.. The students are in charge. The chair is not clear	NELAB	

593.	S	Let do it all together Together ((cough)) Together	The students agree how to run the session.	NELAB	
594.	S	I think it looks like there is some DVLA and stuff…and um …about the flying stuff … which I know we've like, touched on in the past … but this'd sort of be the final thing?…	The students immediately focus on what topics they should study the next week. They mention that some topics have been covered before. No student volunteers any knowledge about the topics that have been previously covered. The tutor does not check what they already know.	NELAB	

595.	S	It's going to be a bit on >like< DNAR orders and like all the ethics and stuff=	Students use a general extender 'stuff' implying they all know what is meant. Hey use relaxed language 'like'	MEO	
596.	S	=Have we already done the …we've already done one on coroners and stuff=	Students talking about what has already been covered.	NELAB	
597.	S S	=Yeh… it would be good to go over it again wouldn't it, 'cos that [[yeh	Agree they should go over things they have already covered but do not try to recap knowledge.	NELAB	
598.		I think it's part of our…	The tutor does not question their knowledge.	MEO	

599.	S S	This week's lectures as well It sounds like its [	Confirming that the topic they are talking about is relevant to the weeks learning as there are lectures on it.	NELAB	
600.	S	[So when… when not to you know coroners you know and all that stuff	Use of 'stuff' again.	NELAB	
601.	S S S	Was that a lecture the other week? (5) Um…	A student asks if there was a lecture on the subject. Nobody answers. There is an embarrassed silence. 5 seconds! Working out what to learn from the lecture list is 'not allowed' in the PBL rules. The students may have been	NELAB	

			worried about my presence in the room.		
602.	S	>Like< to how to actually like manage someone like, what to do >like< we kind of know already because we've done it practically but, you know, what to do when someone's actually in cardiac arrest and what to do afterwards and how to manage them and things↓…	The students move on and ignore the question. A student gets back to the task of brainstorming 'what to study'.	NELAB	
603.	S	Mmm We haven't had a PBL on very acute stuff yet have we?	Talking about what they may or may not have already covered.		

604.	S	Yes	A student agrees with the idea about a study topic.	NELAB	
605.	S	An I don't really know what, don't really know what to do> like<, afterwards, like once you've got them in, back into >like< into sinus rhythm… and all that stuff	A student identifies a knowledge gap. Use of the word 'stuff' implying shared knowledge. Students use familiar slang language 'like' signifying relaxed informal talk	NELAB	
606.	S	Long term management	Another student provides a suggestion for a study topic.		
607.	S	Yes >like< what you do afterwards	Students agree on a study topic but to not consider their existing knowledge.	MEO	

608.	S	Should we do> like< a crash course on cardiac arrest then and have one on the, the long term complications and the stuff for a PBL?	A student suggest a way to divide up the topic. 'One' refers to a topic for a piece of written work to be allocated to a particular student.	NELAB	
609.	S S	Yeh that would be a good idea(0,5)	Students agree on the plan for the study topic.	NELAB	
610.	T S T	Well there's a protocol isn't there for arrest (.) that you have to know [yeh [for the OSCE	The tutor suggests a protocol possibly suggesting they do not need to do a written piece on the topic (with a question tag) and suggests they all need to know it	NELAB	

			for the exam at the end of the module.		
611.	S	Yes , Yeh (5)	Students agree with the tutor.		
612.	S	Obviously there's that, yeh there's that protocol, it (draws the acronym) but what would be quite nice would be to add in the >kind of< OSCE…	Students defend their decision to do a write up on the protocol and decide to make it more relevant to their own exam. They are also trying to work out how to divide up the work to share out and are aware they all need to know the protocol.	NELAB	

613.	S	At the end of the OSCE there's the…you have to say these are the investigations that I'd like to do >or whatever<.	Students start to think about how to add things to the protocol relevant to their exam. A new topic is suggested – investigations.		
614.	S	[Yes [Yes yeh	Agreement.	NELAB	
615.	S	Presumably that relates to the long term…		NELAB	
616.	S	[Yes			
617.	S	Follow up care?		NELAB	

618.	S	It says though…obviously it says, they investigated her and found out that she had anterior MI. Once she was in hospital... just what investing[ation so that's already done	Students look at the scenario again.	TIME: 1.34.22.3	
619.	S	[Yes following		NELAB	
620.	S	I know we've >kind of< done that all before but more specifically	Students signal they have some knowledge	MEO	
621.		( )		NELAB	
622.	S	So do, do differential diagnosis of blackout as well (.) [in that scenario↓	A student makes another suggestion for a learning topic.	NELAB	

623.	S	[( ) indicates a definite cardiac one so it's not syncope. Well - less likely to be↓	Students consider the case again and topics that might be relevant		
624.	S	Mm		NELAB	
625.	S	Do feel like we've covered pacemakers enough? (3)	A student indicated they have some knowledge of pacemakers. Suggesting a topic and also checking others knowledge. The students do not volunteer knowledge about pacemakers. The tutor does not ask them what they know about pacemakers	NELAB	

Break from 625- 693

693		( )	The conversation dries up		
	T	This is a point of interest. This story. A couple of weeks ago, I met a man >you kn( )<, who had a renal transplant. He had diabetic myopathy and he had a cardiac arrest (.) at a gym um >which I think was ( )< just been taken over by Virgin and Virgin had a policy that they needed (.) they ( ) all the staff had to be trained in CPR and had a defib on	The tutor (previously quiet) tells the students about another case similar to the one they have been given	LONG	

		site. >whereas before it didn't< and he had his arrest seven days after the staff were trained. And so he came (in) obviously they brought him back > um< …so anyway if he <u>came in</u> and (.) <u>so (0.2)</u> you'd got a man who <u>died,</u> had a renal transplant of ( ). What would you be suspecting as a cause- he's quite young- he's 40↓		VAG	
	S	Rejection?	TIME: 1.41.23.6	NELAB	
	S	Graft versus host?	The students try to answer the question.	NELAB	

	T	It's about electrolytes	The tutor gives the students a clue.	RMM	
	S	High potassium?		NELAB	
	T	Yes so we didn't we talk ( )> someone mentioned that in the PBL today< electrolytes you'd check. And I was going to ask> I didn't ask at the time< but the most probably, most important electrolyte for arrhythmia disturbance is potassium. Um funnily enough, sodium not↓( ) - doesn't seem so important. Very low high sodium's don't tend to run into (the) cardiac channel. Um would it help now	The tutor relates the case back to something that the students have presented earlier. It is difficult to follow what he is saying. The tutor asks the students lots of things in one go	LONG CLOSE DOUB NW	

		>because you've gone through most of the module now< to just talk about the scenario? and what you know already? In terms of um you've talked about epilepsy part of it so, (.) do you know how to start to form a differential now ? of the syncope? So ( ) someone comes in with syncope in terms of what your differential diagnosis would be and then what questions you'd be asking (3)			
	S	Like?	The student are not clear what the tutor is asking		

Tutorial Group 3

42.		((all chat))	Notes	Code	
43.	S	So, week three is bleeding and Thrombosis. So A Mrs Ethel Smith is an 83 year old lady who lives alone following the death of her husband six months ago. The GP is called to see her following a collapse at home. There is no associated chest pain or palpitations and no neurological symptoms. She does however admit to passing dark offensive stools for the last 24 hours. Ethel has osteoarthritis for which she takes white pain killers from Boots, and	A student reads the scenario.	READ	

		Diabetes rendering her partially sighted. Six weeks ago, her GP commenced her on digoxin and warfarin for atrial fibrillation. Her GP had explained to her that she needed the Warfarin to reduce the chance of having a stroke since then she's been attending the GP surgery weekly for blood tests and has generally been feeling more energetic. She's just completed a course of antibiotics for a presumed urinary tract infection. On examination she appears pale and has extensive bruising down one side where she fell. Pulse is 100, BP 120 over 80, there is some epigastric tenderness but no abdominal masses. The GP takes some blood			

		and send it off urgently. The GP tells Ethel not to take any more Warfarin tablets today and the blood results are phoned through to the surgery that afternoon. Um, so, not going to read them out - Haemoglobin is low, MCV is really low, white blood count is normal, platelets are raised, and iron is pretty off the scale there. Ethel is not keen on hospital admission and the GP phones up the anticoag-nurse for advice. Do you want to discuss this [one first?		NELAB	
44.	S	[Yes=	Students agree how to run the session.	NELAB	

45.	S	=[Uh huh [yes [uh huh	General agreement.	NELAB	
46.	S S S	(0.2) So, there's some pretty obvious signs we need to think about (.) bruising and (0.2) clots (.) really because she's talking about warfarin and anti-coagulation. Um I think they're getting at (.) they said 'stroke', which is (0.2) again, clots in it.= =Mmm = =So, I'm thinking, (0.2) going on the lecture that we had, that, what we were supposed to	Student who read the scenario suggests a topic for study i.e. guessing the learning outcomes. The student mentions what is being taught in lectures that week.	NELAB	

	S	have but didn't happen. Might be good for going over (0.2) clotting? ((laughter))=			
47.	S S S	Coagulation cascade? ((Laughter)) [yep, that's the one!	Students laughing about the obvious deduction about what they should study.	NELAB	
48.	S S	[There's also 'cos there's a history of an infection so, that would mess up the INR as well? (0.2) [so	A student talks about the case and introduces discussion about INR.	ELAB	

		[yeh=			
49.	T	= What else EXT can em, what else can (0.2) change their INR? (2.5)	The tutor picks up on the student's contribution and asks a question. The topic of discussion moves from discussion about what to learn to existing knowledge. Students begin to talk about medical concepts rather than topics to learn.	LIST EXT WAIT	
50.	S	Warfarin (0.2)		ELAB	

51.	S	Um, would the other drugs matter? so she's on white pain killers which is presumably the Paracetamol or NSAIDS so kind of general inflammation? (0.2)	Students talk about the information in the scenario rather then what to learn.	ELAB	
52.	S S	Would that? (0.1) is that also a risk factor? 'Cos they've said about her black stools, so she's got a duodenal ulcer and she's bleeding [that would be a sign of blood loss [mmm	Students analyse the information in the scenario.	ELAB ELAB	
53.	S	Well, and there may be an interaction if she is on an NSAID and she's on Warfarin (0.2) That would increase the effect of warfarin	Further analysis of the information in the scenario.	ELAB	

	S [Uh huh (.02) S	[Mmm Make it more kind of bleeding?		ELAB	
54.	T	Is there anything other than drugs that can affect how effective warfarin is?	The tutor uses another extension question to move the students' discussion forward.	LIS EXT	
55.	S	Uh, there's dietary (0.1) things (0.4) I want to say [CRANBERRY JUICE		ELAB	
56.	Ss S S	[CRANBERRY JUICE? = Yes=	All join in and students sounding a little uncomfortable.	ELAB	

		YEH			
57.	S	Is that like grapefruit juice as well? 'Cos that's really bad…	A student asks the other students a question.	ELAB	
58.	S	So we might wasn't to look at just anti-coagulants in general and how they work and what things affect them	The students decide to study anticoagulation	NELAB	
59.	S	Yes			
60.	S	Yes			
61.	S	Cos with warfarin it takes ages to stop it doesn't it (.) is that right?	A students checks his knowledge about Warfarin	ELAB	

62.	S	Yes	Students agree he is correct but so not explain their thinking		
63.	S	Yeh			
64.	S	Well how to reverse it		ELAB	
65.	S	( ) gets increased really quickly but to decrease takes a lot longer	A student explains what she knows about Warfarin		
66.	T	Are there any ways immediately or, how would you manage someone who has a high INR >other than, [	The tutor asks for specific knowledge	SPEC	
67.	S	[Vitamin K give them vitamin K	The student answer		

68.	S	[less Warfarin 0.5)	One student suggests a different answer. The tutor does not correct the student		
69.	S	But Vitamin K like actually reverses	The student explains what vitamin K is important	ELAB	
70.	S	Aha!	A student expresses his understanding of why Warfarin is a better answer		

Break 71- 95

96.	S	Well maybe the fact that she lives alone and she's a fall risk?			

	S	Mmm, yeh		MIN	
97.	T	Why is she a fall risk?=	Open question Intervention tied to students' progress and asking to explain thinking	SHORT SPEC	
98.	S S	Because [she's] [she's elderly [she on [co morbidity	Student answer immediately demonstrating knowledge	ELAB	
99.	S	[asthma, arthritis	Students respond further		

100.	S S S T	[co morbidity and diabetes and she's partially sighted mmm, yeh (0.5)	Acknowledgement and validation fitting in with students' progress. Giving time for students to continue thinking	MIN	

101.	S T	Yes so putting somebody on Warfarin like that there's a lot of things to take into consideration= =mmm (0.2)	Justifying ideas Giving time for students to continue thinking	MIN	
102.	S	Why did she fall? Did we find that out? (.) Just because she's partially sighted? And a bit old? or is it cos she's lost blood through (0.2)		ELAB	
103.	S S	It says [collapsed instead of fall. So I imagine [COLLAPSE	Students pointing out difference between 'collapse' and 'fall'		
104.	S S	Yeh (0.1) So (0.1)			

105.	S	Diabetes shouldn't make you partially sighted so [I'm guessing		ELAB	
106.	S S	[Yeh, (0.4) it can= =Yes, it can do	Students having a disagreement about whether diabetes can affect vision		
107.	S S S S S	Yes [if [it can do it its poorly [controlled [I know it can [yeh [But, I mean the idea is it doesn't (0.1) shouldn't=	Students talking over each other to explain their point Resolution of the point i.e. good diabetic control could	ELAB	

			stop diabetic patient going blind		
108.	S S S S	=[Yes = [yes = [mmm =I think that's another kind of pointer to she's on her own its poorly controlled=	Students relating the fact back to the case	ELAB	
109.	S	=With diabetes you get the neuropathy so you can't feel your feet		ELAB	
110.	S	[Yes			
111.	SS	[mmm [Yeh the control	Students come to an agreement that glucose	ELAB	

		[That makes sense, It's probably the control (0.4)	control is important in diabetes		

Break from 70 - 110

		Yes			
111.		( )? (0.4)			
112.	T	So, just thinking about the collapse side of things, what questions would you want to be asking her? (0.1)	The tutor suggests a topic for the students to discuss.	OPEN	
113.	S	Why did she fall over?	A number of students give answers.	ELAB	

114.	S S	Did she [remember… [Did she ( ) [How did she feel before the fall=	The students try to work out what has happened to the patient in the scenario.	ELAB	
115.	S	=Did she remember [falling		ELAB	
116.	S S S S	[Did she remember falling (1) Yes, cos she might have just tripped over ((Cough)) Um		ELAB	
117.	S	Maybe, about, If she's been taking her blood sugars, what her blood sugars have been like? (3)		ELAB	

118.	S

			the student who originally asked.	CHAL EXT	
121.	S	=I wouldn't think so. I think it's just like, prophylactic, prevent clots forming when you have atrial fibrillation=	Students suggest their thinking about the effect of the drugs on the patient. The student is referring to effect of Warfarin.	ELAB	
122.	S	So, starting on those drugs wouldn't make you feel like more perky and?	Students ask each other questions but	ELAB	

			are not sure of the answers.		
123.	S S	I don't think so I don't [think so no	The students are confused.	ELAB	
124.	S	[No		ELAB	
125.	T	Well, if the digoxin was adequately treating the AF then she may feel better in herself ,[um,	The tutor offers an explanation about the effect of a different drug – 'Digoxin'.	ELAB	
126.	S	[She wouldn't have like, feel the heart beating[	The tutors' suggestion makes sense to a student	ELAB	

	T	[yeh	who adds to the explanation.	LIST MIN	
127.	S S S S	Mmm Yeh (2) Hypertension as well ok But (.)	The students agree with the tutor and the other student.	 ELAB	
128.	S	Well, she, she's got something wrong with her… (good), like, (0.2) 'cos she's got tenderness in her stomach which is not where she fell. 'cos like you can understand the (.) 'cos she had bruising down the side where she fell which is obviously,	A student explains her understanding of the scenario.	ELAB	

		she would be painful but, why is she getting pain in her?=			
129.	S	=Well…( ) [Well I imagine that's related to the blood (.)in the stool	The students share their understanding of the case.	ELAB	
130.	S S S	And she's [anaemic [And she's anaemic Yeh(.)		ELAB	
131.	S	And that's why she collapsed I recon	A student explains why she thinks the patient in the scenario collapsed.	ELAB	

132.	SS	She's a bit ( ) Maybe something else She a bit (0.4)	All talking together and talking over each other.	ELAB	
133.	S	What is digoxin? (0.2)	A student asks a question about digoxin.	ELAB	
134.	S S	It's an anti-arrhythmic so if someone's got an arrhythmia, in a (hurry), it helps (sort of breakup) OK =	11.03.4 Another student Answers the students question.	ELAB	
135.	S	=Isn't it, it comes from foxglove?		ELAB	

136.	S S	Oh yeh Yeh			
137.	S	But I, like, because her INR is so high, that could be the reason for a bleed in the stomach?	Students offer an explanation for the cause of the patient's fall.	ELAB	
138.	S	(mmm I was thinking) (It might)	General mumbling.		
139.	T	What other things, 'cos we've talked about ulcers. What other things can cause GI bleeding?	The tutor ELABs a question to bring the focus of	EXT	

			discussion back into line.		
140.	S S S	Trauma (1) Laughing there always= =Trauma, Infection	The students laugh as they all have their own 'favourite diagnosis'.	ELAB	
141.	S	Cancer		ADD	
142.	S	Bowel Cancer		ADD	
143.	S	Surgical sieve		ADD	
144.	S	Like Crohn's or ulcerative colitis or something		ADD	

145.	T	We talked a bit about um oesophageal varices last week (2)	The tutor reminds the students about something they covered the previous week.	SUM	
146.	S	Oh yeh (hhh) (2)			
147.	S	But that would be acute wouldn't it like? Like you'd ( ) you'd vomit – die	Laughter. The students are trying to compare the new case with the old case.	ELAB	

148.	T	So, so, is this acute or is this chronic?	The tutor asks an either/or question to help the students compare the cases.	SHORT CLOSED	
149.	S SS	This is chronic chronic	Two students give their answer. The tutor does not evaluate the answers.	ELAB	
150.	S	Well, her [MCV's	A student begins to explain what she is thinking.	ELAB	

151.	S	[Well the dark stools only the [last 24 hours		ELAB	
152.	S S	[Last 24 hours Ok, acute		ELAB	
153.	T	What were you going to say about the MCV?	The tutor picks up the point that was lost at line 150.	LIST	
154.	S	I was just going to say it's still, it's still in the normal range. It's on the lower side but, if was more chronic you'd start seeing a lower MCV?	The student gets an opportunity to explain her point further.	ELAB	

155.	T	Yeh, Yes, if you compare that to the case last week and, who was the, the, girl with heavy periods, she was microcytic um, and that was because it was chronic so that she had, (0.1) sort of had time to become iron deficient, um… (2)	The tutor refers back to specific points from the previous case.	SUM	
156.	S	So…she…still in the normal range…		ELAB	
157.	S	It's …acute	The students revise their previous Answer.	ELAB	
158.	S	Why did she have high platelets and high INR		ELAB	
159.	S	Because			
160.	S	If(.), good question ( )			

	S	Surely if you have ( )		ELAB	
161.	S	[‘so, if it takes longer to clot, then why does she have loads of platelets?		ELAB	
162.	S	Recent infection?		ELAB	
163.	S	Yeh, Maybe? That’s a good point.		ELAB	
164.	S	Cos she has just come off the anti-biotics so, I don’t know, maybe she’s got. I’m not really sure to be honest. (1)	The students come to the end of their knowledge.	ELAB	
165.	T	Any other ideas?	The tutor gives the student time to consider their	EXT	

			thoughts a bit further.		
166.	S	Don't you get that in thrombocytopenia' (0.3) um no, no don't worry		ELAB	
167.	S S S S	Don't you get um platelets in inflammation? I know it can, you can get inflammation due to infection but, it could be another inflammatory process? (2) like, (1) I can't really (2) Osteoarthritis is inflammatory? Yeh	The students express they have reached the limit of their knowledge.	ELAB	
168.	SS	Um Yeh	TIME: 13.17.9		

		Um	General mumbling and students expressing they have run out of ideas.		
169.	SS	Is it…			
170.	SS	Um			
171.	Few	Could be um (0.3)			
172.	T	Is it (0.1) er I would have thought er, I would have thought the most likely cause would be the acute bleed? So you can um, you have the ability to compensate when you start bleeding, so, you start producing more platelets so, you're right it	The tutor offers his explanation of the case.	SUM	

		could be infection and any number of things, um but it's quite, um quite important to have a look at how your body adjusts in those kind of circumstances			
173.	S	So they would go up that much? In acute? I suppose it is 24 hours it's quite a long time. It's probably worth going over the response to bleeding coagulation cascades as well as like the production of cells in response to ( )? Um	Identifying a learning deficit and a topic to study.	NELAB	
174.	T S	So what do you want to do with this patient do you want to ask any more questions or ?(4) You want to give her an endoscopy (3)	Bringing focus back to patient case.	ELAB DOUB WAIT	

			A student concludes that the patient has probably had a bleed from the stomach and this needs further investigation.		

Break from 174- 271

270	S	What's his CURB score lets work it out (3) ((Laughter))			
271	T	What's… [what's a CURB score?		SHORT SPEC	

		[(that's) respiratory S?	The students remember this from a previous module		
272	S	CURB Erm so Confus-		ELAB	
		[confusion,			
		[Confusion his urea we really don't know, so it's the C U R B			
		Isn't it, Resp?			
	S	Resp- mmm, resp, resp we don't have	They look for the data they need		
273	S	Blood pressure we don't have	Students work together to find the data		
274	S	Don't know			

275	S	(Mumbling) the pulse=			
276	S	=And he's got confusion			
277	S	At least two			
278	S	(Has he) got pneumonia?	A student questions the relevance		
279	S	(Laughter) so we need to send to hospital anyway, but I don't think he's got			
	S	pneumonia? (But) like you'd have to have pneumonia to send someone to hospital for pneumonia		ELAB	

393	S S3 S S	[-that suggests he doesn't have a clotting problem – ((Mumbling and [laughter)) [I ↑would like a D-dim(hh)er	The students are discussing what tests to order for the patient.	NELAB	

	S T	(Student name) wants a D-dimer >which I thinks a good idea< °Uh[huh°			
394	S S Ss	[I think that's a very good [idea [That's a good idea ((laughter)) ((Mumbling))	The students suggest a test without explanation for the use.	NELAB	
395	T	What do you know about D-dimers? (3)	The tutor questions their knowledge.	LIS OPEN	

396	S Ss S	It's good to rule out [s- [(mumbling) Yeh	Together the students give an explanation.	ELAB	
397	Ss S s S	(rubbish) If it's yeh, you ca:an't use it to confi::rm 'cos it could be high in like in post infection or (.) anything [but, [coul- you, it's got, if it's l::ow, (.) it's er unlikely to be a (.) PE.		ELAB	

Tutorial Group 4

1586.	S	Yes			
1587.	S	(NAME) are you all right to read	The students decide how to run the tutorial and who will read.	READ	
1588.	S	That's fine		NELAB	
1589.	S	So you read it all first and then we'll do it again ( )?			

1590.	S	Scenario one Stephen Speedy is a 48 year old man who has ( ) complaining of palpitations and dizziness he is pale and clammy his pulse is 200 BP 80 over 50		READ	
1591.	S	Oh			
1592.	S	His ECG that shows a regular broad complex tachycardia the anaesthetist is called and Mr Speedy has emergency DC cardio version this restores his sinus rhythm he feels much better and his BP is now 110 over 75 prior to this episode Mr Speedy has been fit and well and does not have any past medical history of note he delivers furniture and drive a lorry, drinks	A student reads the scenario. It is generally not thought a good idea to use silly names for patients when a serious discussion is	READ	

		beer occasionally but only when not driving. He enjoys jogging and going to the gym he's married with two kids his father died suddenly at the age of 43 of unknown causes his mother is well he has a young sister who had something wrong with the heart when she was a baby and continues to have problems in adult life but he is not entirely sure of the exact problem blood tests show abnormal electrolytes	intended. Mr Speedy the lorry driver!		
1593.	S	( ) normal			
1594.	S	Normal electrolytes sorry ( ) mildly ( ) his ECG now shows sinus rhythm with left ventricular atrophy he has an			

	S	echocardiogram and coronary angiogram as part of his work up the echo shows mild atrophy of the septum the coronary angiogram shows unobstructed coronary arteries. Mr Speedy is told that he has a hypotrophy cardiomyopathy he is started on a beta-blocker and advised to have a defibrillator implanted he is worried about what impact his condition will have for him and his family. His daughter is about to become a professional footballer he is also concerned about having a defibrillator implanted and the restriction it will have on driving.	From the scenario it is not clear if the students are expected to try to work out ? One of the student very quietly mentions what he thinks is wrong with the patient. HOCM – (hypertrophic cardiomyopathy). The other students and tutor do not respond. They may	READ NELAB	

		That's scenario one °HOCM°	not have heard, they may not understand or may think it an irrelevant comment.		
1595.	T	O::k:: hh so, (0.2) if we go back up to the top…>or do you want to do both of them together and then?<	The tutor is sounds a bit tired… A student starts unwrapping a sweet. The tutor gives the students the option of how they want to analyse the scenarios.	DOUB	

1596.	S S S	[Might as well [Just do one at a time [One at a time [Just Right	They want to look at one at a time and the tutor goes with that.	NELAB	
1597.	T	OK, Right, so out of that first initial bit, (0.2) so he comes in with palpitations…dizziness. So what do you think? (0.4)	It is not clear what the tutor wants to students to be thinking about? She says initial bit but this is not very precise.	TIME: 2.07.58.8 DOUB VAG	

1598.	S	Tachycardia		NELAB	
1599.	SS	((overlapping speech))	Lots of students talking together.		
1600.	S	Supraventricular [and ventricular		NELAB	
1601.	S	[It's (0.3) not supraventricular	2 students enter a debate about whether the rhythm is supra ventricular or ventricular tachycardia.	NELAB	
1602.	S	[It ↑is ventricular		NELAB	
1603.	S	He's got [		NELAB	
1604.	S	[Because you've got VT		NELAB	
1605.	S	Yes		NELAB	

1606.	S	Yes, yes we should probably do both – ventricular and supraventricular	To resolve the situation a student suggests they should 'do both' the sorts of arrhythmia i.e. study both that week.	NELAB	
1607.	S	Well we're looking at tachycardia's now aren't we now ↓		NELAB	
1608.	S	Oh yeh the case…		NELAB	
1609.	T	Right, so we've got an umbrella term of arrhythmias. So you said ventricular arrhythmias and supraventricular (0.4) Anything else… that's going on there? (2)	The tutor does not explore the student's knowledge of supraventricular and ventricular tachycardia.	SUM VAG	

			But seems happy that they agree they need to do both. Then she summarises. There she asks another rather vague question. There is a pause before a student replies.		
1610.	S	Cardio version?	The response is short and nonelorate.	NELAB	
1611.	T	In that initial bit. Yeh↑	The tutor repeats 'initial bit' She acknowledges the student's Answer but it	VAG SUM	

		So we've got arrhythmia's and sort of management of arrhythmias	does not appear to be what she is looking for.		
1612.	S	Rate control and rhythm control, 'cos you've got to manage the the rhythm (but also kind of do rate control) …you then - he's given beta blockers as well so… rate control …	Students begin to talk about the management of arrhythmias.	TIME: 2.08.52.9 ELAB	
1613.	T	Ok, anything else to add on that initial bit? The only other thing is I think is - do you remember in the past we've talked about stuff that is like very acute. So is that patient well or unwell?	The tutor acknowledges the Answer but does not expand on it. Again the tutor asks about the initial bit. This time the tutor does not give students any time to Answer – she tries	INTER NLIS VAG NW CLOSED	

			to explain what she is thinking… The tutor uses relaxed languge Stuff and like .The tutor asks a specific closed question.		
1614.	S	Unwell		NELAB	
1615.	S	His BP is really low as well	A student expands on the answer.	NELAB	
1616.	T	Ok, so we can have a think about,> possibly<, so if you've got someone with a broad complex tachycardia and a <u>low</u>	The tutor explains her thinking.		

		blood pressure…if they then have no blood pressure… what sort of management are we moving over towards?		VAG	
1617.	S S	Shock him Give him fluid	The students provide specific management ideas.	NELAB	
1618.	T S T	We've done before yes exactly ALS type stuff, shockable and non-shockable rhythms and then maybe we can think about that? potentially? mmm OK↓	The tutor agrees and then suggests that at some time in the future they will look at 'ALS type stuff'. She briefly touches on a topic they have covered before – but only to	SUM	

		'Prior to this episode Mr Speedy has been fit and well and doesn't have any past medical history, delivers furniture and drives a lorry' Anything pertinent there?	mention they have done it…she does not find out what the students know. Then she goes back to the scenario.	READ VAG	
1619.	S	Sat down quite a lot ↓(hhh) … sedentary↓	One student is sounding rather fed up.	NELAB	
1620.	S	He drives a lorry so isn't that group 2b?		NELAB	
1621.	S	Yes, so he's got to declare it…and he's got to be deemed asymptomatic for is it six months? As far as driving…		NELAB	

1622.	S T	Mmm Yeh	No clear whether 6 weeks is the correct time…or yes they need to do it.	TIME: 2.09.59.1 Vag	
1623.	S	Mumbling			
1624.	S	So social …economical… nightmare ((Laughter))	Student expressing his lack of enthusiasm in researching the social impact of disease.	NELAB	
1625.	T	Fine ↓… ok↓…. and then we move a little bit onto the family history so what. What is that paragraph kind of… for? (2)	The tutor is asking the point of the paragraph.	VAG	
1626.	S	Cardiomyopathy		NELAB	

1627.	S	43 years is quite young for whatever his father died from of possibly cardiac that's what you're worried about for under 55 aren't you?		NELAB	
1628.	T	Yes			
1629.	SS	((Talking over each other)) causes of sudden death			
1630.	S	I think that heart sudden death at a young age is giving the hint there	Student suggesting that the scenario is hinting as to what they should study.		

1631.	T	So you're saying that his father died young and you think it's a cardiac thing and we know later on that later on that he's diagnosed with HOCM. So do you know much about HOCM?	The tutor asks if they know rather than to tell her what they know	SUM CLOSED	
1632.	S	It's also saying he does have HOCM		NELAB	
1633.	SS	Yes( )			
1634.	S	Well he has all the investigations that are positive		NELAB	
1635.	T	For that… fine and what was his mum? His mum was well… younger sister has got something wrong with her heart so what is that whole paragraph asking us to look at?	Tutor asking the students about what they think they should study not	SUM VAG	

			about their knowledge of HOCM.		
1636.	SS	ASD paediatrics		NELAB	
1637.	SS	Look into history of cardiac problems		NELAB	
1638.	T	Have you covered that before? Congenital heart conditions?	The tutor asks if they have covered it before but does not attempt to discover what they know.	CLOSED	
1639.	S	NO		NELAB	
1640.	SS	We haven't actually		NELAB	
1641.	S	No		NELAB	

1642.	T	Ok so cos that's massive, a massive topic so we'll talk about that a bit later, um, echo's and coronary angiograms etc. we've kind of		ORG	
1643.	S SS T	We've done that We covered that We've done that a lot, haven't we OK	The students tell the tutor they have covered a topic.	NELAB SUM NELAB	
1644.	T	A lot haven't you ok did we cover HOCM when we did that then?		CLOSED	
1645.	S	No		NELAB	

1646.	S	[we haven't done any cardiomyopathy in paediatric or oh well we have done arrhythmias - but in secondary care teaching well		NELAB	
1647.	S	[We haven't mentioned		NELAB	
1648.	S	NO We haven't done properly cardiomyopathy or congenital heart disease		NELAB	
1649.	S	And I think this week is all about it	The students discuss what the topics for the week might be.	NELAB	

1650.	T	So that's going to be quite big isn't it ok fine and then do you want to move down and just see if there's anything else there that you feel we should cover ↓in that scenario?	The tutor is helps the student organise what to learn They do not have any depth f discussion	ORG INST	
1651.	S	Defibrillator Defibrillator indications?		NELAB	
1652.	T	Yes		TIME: 2.11.47.9	
1653.		complications for different (relations)		NELAB	
1654.	T	Definitely			
1655.	S	Pain? (3)		NELAB	

1656.	T	Yes			
1657.	S	We haven't done about implanted cardiac devices have we ( )		NELAB	
1658.	T	No			
1659.	S	Or about like pacemakers or anything like indications that		NELAB	
1660.	S	They come in this week		NELAB	
1661.	S	Yes		NELAB	
1662.	S	Pacemakers and		NELAB	
1663.	SS	Talking over each other		Int	
1664.	S	ICD's		NELAB	

1665.	T	And you also see that he's started on a beta-blocker so with regard to management medical management of arrhythmias		VAG	
1666.	S	( )		NELAB	
1667.	T	Its kind of what you were saying yes		VAG	
1668.	S	And the classification I can't remember the name it begins with B		NELAB	
1669.	T S	( ) Vaughn Williams I that the one you…		NELAB	
1670.	S	Yeh yeh		NELAB	

1671.	T	Ok anything else you want to pull out of that scenario (5) there's a little bit there about troponin but we have done that		VAG W CLOSED	
1672.	S	It's wanting us to do socioeconomic isn't it psychosocial Psychosocial	Students' referring to what the scenario wants them to study.	NELAB	
1673.	S	Yes		NELAB	
1674.	T	What make's you say that (name)	The tutor joins in with the students.		

1675.	S	His daughter is about to become a professional footballer um		NELAB	
1676.	T	And the driving stuff			
1677.	S	Yes			
1678.	T	And the family indication		NIEK	
1679.	S	Mm			
1680.	T	Yes ok			
1681.	S	Shocker Laughter		NELAB	
1682.	T	Right shall let's do the next one and then we'll make a list		ORG INST	

Tutorial Group 5

62.	S	(general chat)	Notes and time	CODE	
63.	S	Ok so um Hussein McCloud is a 45 year old	STARTS AGAIN 8.18.1		
64.	S	Sorry			
65.	S	Hussein McCloud is a 45-year-old disc-jockey in Yarmouth, overweight, he does not smoke or drink much alcohol but, works very irregular hours with no exercise at all and loves his crisps. He has West Indian, Scottish parents both of whom had high blood pressure for many years. He had his	Reading the scenario.	READ	

		blood pressure done at the chemist where it was found to be very high so, he made an appointment to see his GP. His GP asked about any other symptoms such as; palpitations, shortness of breath or change in weight or shape, thirst and increase frequency in urination, whether his family were hypertensive or heart blood problems. Blood tests were arranged to include HbA1C and glucose, U's and E's, lipid profile. Urine was dip-sticked and was sent for an ACR. A 24-hour ambulatory blood pressure monitor was analysed and came back as raised with an average of 168 over 88. His			

		cholesterol was raised. He used a Q risk calculator to predict the likelihood of cardiovascular problems in the next 10 years. His risk came back at 22% and he was offered a statin which he was reluctant to take as his father had the most awful aches and pains when he had taken a statin. He discussed these results with his GP and asked to try diet and exercise first, even though his GP thought this was unlikely to be enough. One year later he had lost 5 kilograms in weight and his blood pressure was 165 over 90. In clinic Mr McCloud has become more worried about his			

		hypertension because his father had recently been found to have an irregular pulse and had been started on warfarin medication. His GP reckoned that he would need at least two agent but started him on Ace inhibitor first, though found it difficult to choose between that and the calcium channel blockers. He also asked for advise on whether he should join his work colleagues on a sponsored bicycle ride in May in the Himalayas and asked how would it effect his blood pressure (6.3).			
66.	SS	( )	TIME: 10.18.3	NELAB	

	S S	Shall we (cough), shall we go round? Yeh	General mumbling		
67.	T S	OK? (1.4) When you're ready ((Coughing)	Laughter. The students are settling down to the session.	INST	
68.	S S T	Risk[[There's clearly a lot about blood pressure You could throw in ( ) if you wanted to[	A student starts to write on the white board and needs the board rubber. The tutor asks a student to 'throw it in'. A student	NELAB INST	

			looks for the board rubber.		
69.	S	[It's risk week=		NELAB	
70.	S S S S S S S	=Risk yeh (0.2) RISK …In the middle Careful Is it risk? Uh huh... RISK That's… it's not hypertension yet No	A student is still looking for the board rubber. Students begin to discuss what the topic of the week is. They are not sure if it is risk or hypertension. They trying to decide what to learn.	NELAB	

71.	S	Risk		NELAB	
72.	S S SS	That's, they were all risk factors a:ll the way through it Yeh… ((Mumbling)) ((Cough)) ((Drill starts))	A student defends his idea that is it risk week pointing out that there were risk factors in the case scenario	NELAB	
73.	S S S	So… Starting with risk factors… Starting with the first line …with he, he's a disc-jockey maybe about lifestyle… job…	The student suggest that the patients job might be a risk factor for heart disease but do not explain	NELAB	

			what aspect of his job would be relevant.		
74.	S S	Yeh Um		NELAB	
75.	s S	Hypertension (2) Hypertension?	Some students think the topic to study that week is hypertension others still think it is risk.	NELAB	
76.	S S S	°Its hypertension week° But, it is hypertension week No… no... it is hypertension….hhh	A student begins to insist they need to study hypertension that week.	NELAB	
77.	S	Just serious risk assessment		NELAB	

	S	Potential of like family history			
78.		( )			
79.	T	Ok↓ we're just going to think about risk and risk factors. Clearly there's a lot in here so instead of having a huge list, why don't we actually try and <u>cat</u>egorise them? At this stage, -might make life a little…[	The tutor directs the students to focus on risk. He does not clarify whether it is risk week or hypertension week.	ORG	
80.	S T S	[Shall we do like, [a little simpler? [Modifiable	TIME: 11.19.6	NELAB	

81.	T	Modifiable and non-modifiable	Tutor gives students headings into which to classify risk.	CLOSED	
82.	S S	Yes Yes that's good Mumbling	A student writes the headings on the board. The student wants to rub out something she has written.	NELAB	
83.	S	Something to rub it out	The student can't see the board rubber.	NELAB	

84.	S	Isn't the rubber( )( )	A student suggests where the board rubber should be.	NELAB	
85.	S	((laughter))	Laughter		
86.	S	Underneath,	A student points to some papers on the desk that have been put on top of the board rubber.	NELAB	
87.	S	Yes yes sorry		NELAB	
88.	T S	X its here Oh ((Laughter))	The tutor shows the student where the board rubber is.	NELAB	

89.	S	( )( )	Getting back on task. The student rubs out what was on the board.		
90.	S S	So modifiable … So what are the other ones?	The students settle back down to classifying risk factors into modifiable and unmodifiable.	NELAB	
91.	S	Other	They come up with a new category ‘other’	NELAB	
92.	T	Do you want to start again?	The tutor suggests that they start again as the writing on the board is not clear	INST	

93.	T	(student name)	Names a student to restart.		
94.	S	So	Students begin to list the risk factors they know – but there is no depth to the conversation.	NELAB	
95.	S	Family history		NELAB	
96.	S	Lifestyle			
97.	S S	Yes family history lifestyle How many questions do we need[	A student asks how many questions they need to organise. Possibly the student is asking how many official learning	NELAB	

			outcome they need to identify from the case– not focused on thinking about the case.		
98.	S	[So within lifestyle we can put those things up	The other students ignore the question.	NELAB	
99.	S	Occupation	TIME: 12.15.3	NELAB	
100.	S	Alcohol, drugs, [smoking, diet	The students continue to list risk factors for heart disease with no elaborative dialogue.	NELAB	
101.	S	[Alcohol, smoking	The tutor does not ask why smoking is a risk	NELAB	

	S S	Some ( )[[Is occupation modifiable?	factors for heart disease or how much alcohol is a risk factor		
102.	S S	Yes- You can always move[		NELAB	
103.	S S	[yeh, you don't have to stick to ( ) You don't have to		NELAB	
104.	SS	All talking (10)	Laughing and talking over each other for 10 seconds,	NELAB	

			the tutor does not intervene.		
105.	S	So, with occupation would, were really talking about irregular working hours as well… talking about ( ) because it goes onto say like um, they're not very regular ….he works irregular hours and it…therefore leads on to exercise?		NELAB	
106.	S	Or diet (3)		NELAB	
107.	S	Yes		NELAB	
108.	S	You've got to rule that out like 'cos[		NELAB	
109.	S	[And even		NELAB	

110.	S	[Eating at the same time as everyone else so ( ) and time to make proper dinners and stuff	A student begins to explain why irregular working hours can lead to bad diet.	ELAB	
111.	S	And even though he might not have smoked he might have back in the days when people used to smoke in pubs he might have been affected by that		ELAB	
112.	S	Back in the day ((singing))	Singing- some members of the group join in singing a song…	NELAB	
113.	Ss	Back in the days (4)	2 students singing and laughing.	NELAB	

114.	S S	[Age …sex… [Could we		NELAB	
115.	S	[Could we also put like attitude to health? Like help- what's it 'help↑ belief↓'? mmm, 'cos he doesn't want to take statins and things	TIME: 13.12.0 A student tried to recall a social health model	NELAB	
116.	S	And with non-[modif		NELAB	
117.	S	[but he doesn't want to take them because of the [effect of them? [no one like	The student is still trying to recall the 'health belief model' but she can't	ELAB	

	S S	Yeh, but that's the thing the help bi (– um)	remember exactly what it is called. Student trying to recall the words 'health belief model' but is unable- nobody helping her. The tutor does not pick up on the point.	MEO	
118.	S	( )			
119.	S	But diet could be good or bad as well		NELAB	
120.	S	Huh?		NELAB	

121.	S S	Diet can be good as well as bad (2) Does that make sense? Sure	The tutor does not check what the students understand by a good diet in relation to cardiovascular disease prevention.	MEO	
122.	S	Uh hum Yeh			
123.	S s s	It says 'He loves his crisps' Uk hum which are obviously bad but they're also like omega 3 and stuff potential? Benefits?	A student begins to consider the components of a good diet	NELAB MEO	

				ELAB	
124.	S SS	He could have a really good diet other than the crisps ((Sniggering))	The student are laughing and not really taking it seriously.	NELAB	
125.	S	Q risk?	A student tries to get the others back into line by suggesting a medical term/ calculation for measuring a patients risk for cardiovascular disease.	NELAB	
126.	S	(Name) just, just write what, them down and we can like – group them	The student who is writing on the board is not sure what to write and looks to		

			the group for clarification. A student tells her just write it all down so they can later group them. (unclear why).		
127.	S	Another risk, cardiovascular risk-		NELAB	
128.	S	-Assessments [things [Assessments yeh		NELAB	
129.	S	Different ways of assessing your risk(0.5)		NELAB	
130.	S	And there can we put- have we done pharmacology of statins↑?	Students checking what they have covered before.	NELAB	

131.	S S SS S S S	Yeh ((yawning)) we [have [Plus, plus ((Lots talking)) Not(risk)? We need the whole [cholesterol pathway [pre	A student replies that they have. The tutor does not check what they already know. A student is asking if is risk week again. A student is pointing out that they need to know the cholesterol pathway	NELAB	
132.	S	It's the name, of the week - pharmacology…	Students referring to the topics to study for the week.	NELAB	
133.	S	°And hypertension°	TIME: 14.13.7	NELAB	

	S S	.hh, °Oh right°	A student mentions very quieting that it is 'hypertension' week.		
134.	S S S S S	The name of the week is like, Cardiovascular assessment[[and hypertension hypertension and pharmacology [so it's not just on risk [oh yeh	Students still trying to decide what the topic of the week is, whether it should be risk or hypertension… A student points out that the title of the week is cardiovascular hypertension and pharmacology.	NELAB	

135.	S S	( ) like ( ) ( ) list of drugs ( )	Students talking over each other discussing what the topic is for the week.	NELAB	
136.	SS	[Yeh It is ( )		NELAB	
137.	SS	All talking	The students are still unclear about what topic they are learning.	NELAB	
138.	SS	We need to list them ( )		NELAB	
139.	S	Um, why was he had his blood pressure done at the chemist was that like a screening thing?		NELAB	

140.	S	Yes cos, oh yes?		NELAB	
141.	S S S	Oh Yeh what is it…? good question		NELAB	
142.	S S S S	Um (5) Um °General screening so° Um (4)	The conversation dries up. Long pauses and silence.	NELAB	
143.	T S T	There's a few , um little bits at the start isn't there Youv'e got your…	The tutor intervenes with an unclear statement.	VAG INTER	

		if you look, if you look throu:gh↓ he's had his blood test done at the chemist and then when he goes to see: his GP's saying…his GP's(0.1)	Tutor trying to help students clarify what the topic of the week is by considering information in the scenario.	VAG	
144.	S	Routine test ( )			
145.	T	Asking what?	Unclear question.	VAG	
146.	S S	[Did [Symptoms?		NELAB NELAB	
147.	T	Yes (0.5)		VAG	
148.	S	So that's screening as well isn't it	The students latch on to the idea that perhaps they	CLOSED	

			are supposed to be learning about screening in that week		
149.	T s T S T S	So, I think we've just got to be clear, if you talking about screening, should you be scr... are you to talking about screening as in should we be screening everybody for coronary artery disease? Mmm	TIME: 15.14.8 The tutor does not ask the student what they know about screening. He explains something about screening.	VAG VAG CLOSED	

	T	Or, should you just be asking people a list of screening ((Coughing)) questions, if you think they're at risk? (1)		VAG	
150.		Mmm			
151.	T S T	So there's two different sorts of screening …(1) Mmm well, no there's one sort of screening but there's two, there's two options for it (3)	Tutor is not aware of what lectures the students have had.	VAG	
152.	S	So does that lead to what actually like a decent screening test would be? What,	A student asks whether there was a lecture on	NELAB	

	S	what – ‘cos didn’t we cover that last week in that cross [(module)? [Yeh	screening. He asks if it was a ‘cross module’ lecture rather than a lecture specifically for their module (because if so it may not be a learning outcome for that particular week). Students are trying to decide whether they need to study screening ‘this week’ or whether this has already been covered in a lecture. The students’		

			discussion is heavily focused on working out what topics to study.		
153.	S S S	[Yeh … what the s- [( ) the criteria- -criteria	The students recall something from the lecture about screening.	NELAB	
154.	S S	Yes That's the one criteria	A student recalls there are screening criteria – the tutor does not ask the student to elaborate.	NELAB	
155.	T	We talked about that with Stroke last week	Tutor reminding students they covered the topic in the previous week. He	SUM	

			does not check what they know.		
156.	S	Yes		NELAB	
157.	S	About ( )		NELAB	
158.	S	Do we want to go over that again? ((Banging noise))	The student are questioning if it is worth going over screening criteria again.	NELAB	
159.	S S SS S	There is [only like 5 points that we like need to know [There up there Yeh..	A student suggests it is not worth going over again as there are only 5 key points. A student	NELAB	

	S S S S	Can you list them? ((laughter)) Yeh! [Come on [You could	challenges this and asks ‘Can you list them?’ The students laugh at the question- possibly embarrassed because they can’t remember them (or possibly did not attend the lecture). Attendance at lectures is supposed to be compulsory but in reality keeping a check on lecture attendance is tricky with 170 students in a year group.		

160.	S	[There's; always cost effective…, specif(h)ic ((laughter))	Some students start trying and list some screening criteria but struggle...	NELAB	
161.	S S S S	You can get um [[Always cost effective, Specific and sensitive ((someone clicking fingers)) °Specific° hh Investigations?	Sudden change of topic. Rather than actually trying to remember and revise the screening criteria, a student moves them back	NELAB	

		(we could produce)	on to the task of brainstorming what to learn. The tutor does not intervene to help the students recall the 5 screening criteria.		
162.	S	Yes 'cos there's loads of (page) of new ones		NELAB	
163.	S S S S	Blood tests, so… (cough and mumbling) -(that could) [Aetiology yeh (mumbling) (0.5)	TIME: 16.26.6 Students are listing words. There is no depth to the conversation.	NELAB	

	S	°You could° (0.3)	Conversation dries up.		
164.	T S	You say investigating,[primary care investigations [cos’	The tutor tries to pick up what the students are saying.	LIST	
165.	S S S	[Yes [Was that to [Erm	The students talk over one another.	NELAB	
166.	S S S	Well they did blood tests, they took er… ambulatory blood pressure [Yrh- [yeh		NELAB	

		[And that's…			
167.	S S S	[(---) be see↑ [(0.3) ((Banging noise)). Eh, ew (1.2) °diet, exercise°	Conversation dried up again.	NELAB	
168.	T S	Is it just blood tests? Based on[…(ACR) [No,	The tutor asks another unclear question.	VAG	
169.	S	Urine	Students keep listing tests without any explanation of why they are important.	NELAB	

170.	S S S	Um Urine Urine (Mumbling) lipid profile		NELAB	
171.	s S	[Isn't the HbA1c diabetes? Although… Yeh		NELAB	
172.	S	[Lipid profile as well (0.9)		NELAB	
173.	T	Why do you think all of those things are important?	The tutor asks the students to explain why all these tests are important.	OPEN	
174.	S S	[They're risk factors [Risk fact- yeh	The students reply and talk over each other.	NELAB NELAB	

175.	S	[Trying to rule out as much as you can (?) (0.3)		NELAB	
176.	T	There's things you can change isn't there…	Rhetorical question.	CLOSED	
177.	S	Mmm (1.1) yeh	Students agree with tutor.	NELAB	
178.	S	Um, We haven't mention he's of West Indian and Scottish parents	Change of topic, looking at scenario but vague statement.	NELAB	
179.	S SS	Isn't that, doesn't that like going down in family history All talking together		NELAB	
180.	SS	Ethnicity		NELAB	

	S S	Yeh It's a risk factor isn't it			
181.	S	°yeh°		NELAB	
182.	S	There also a population( )		NELAB	
183.	S S S	Also, the fact that he's had a 24 hour blood pressure monitor thing, means that, that rules out white coat syndrome doesn't it? so… What? He had a 24 hour blood pressure	TIME: 17.37.4 A student questions the meaning of '24 hour blood pressure' and 'white coat syndrome'. The student just repeats what she has said but	NELAB	

			does not explain what it means.		
184.	S S S	Isn't that [in the guidance? [Isn't that just telling you though... You have to have one of those before you can be diagnosed [hypertensive? (0.3)	Another student starts to try to explain her understanding of 24 hour blood pressure.	ELAB	
185.	S	[Yes (0.3)		NELAB	
186.	S S	So maybe the blood pressure guidance [so		NELAB	
187.	S	Yeh we could do that one	Students deciding they should study blood pressure guidance.	NELAB	

188.	S S	Isn't there a week [on blood pressure? [guidance	A student asks if there is a week on blood pressure.	NELAB	
189.	S S S	(quiet laughter) (0.8) (some whispering among students) °↑What?° °you talking…? ° Is there a week on blood pressure or not? ((More whispering)) ((whistling))	Uncomfortable silence. The student is not clear if they are going to be studying blood pressure this week or not. Appears the other students know it is an LO this week and explain this to her, but in a whisper.	NELAB	

190.	S	Do we need to go over ACE inhibitors and calcium channel	Change of topic.	NELAB	
191.	S S SS	Do we have to do warfarin again? Well I think there's a presentation up about why you'd use one instead of… ((Mumbling))		NELAB	
192.	S	Bit of pharmacology yeh…		NELAB	
193.	S	We need cholesterol yeh( ) ((Mumbling))		NELAB	
194.	S	And Calcium channel blockers ((Mumbling))		NELAB	

195.	S	We've done warfarin quite a bit		NELAB	
196.	S	Calcium channel blockers as well		NELAB	
197.	S S	Do you want to know So you want to just do the pharmacology of		NELAB	
198.	S S	And also like ((Mumbling)) You know the ABCD of		NELAB	
199.	S	Mumbling all talking together … do the pharmacology of those		NELAB	
200.	S	[Like he had ( ) what would you substitute		NELAB	

201.	S	Yeh		NELAB	
202.	S	[Instead yes		NELAB	
203.	S	[What's your alterative to	TIME: 18.43.2	NELAB	
204.	S	So pathways of the 'if not this' and also the cholesterol pathway		NELAB	
205.	SS	mumbling		NELAB	
206.	T	Do you what to just… what you're saying about, about anti- hypertensive agents, do you just want to try and put that in a nutshell?			
207.	S	Treatment for hypertension		NELAB	
208.	S	Antihypertensive or		NELAB	

209.	S	Or Pathways isn't in – would there be a pathway?		NELAB	
210.	T	Yes, yes and pathways are normally based on (0.8)			
211.	S	Something			
212.	T S T	Guidelines yes? Oh ↓ right so like NICE guidelines? So you (0.7)			
213.	S	°I hate doing group stuff° ((Laughter))	Uncomfortable silence followed by awkward laughter.	NELAB	

214.	S	Do you want to do the pharmacologies of them all		NELAB	
215.	S	Yes		NELAB	
216.	S	((Mumbling))		NELAB	
217.	S	Um		NELAB	
218.	S	So you want go through line by line 'cos it's really slow…	A student expresses his frustration.	NELAB	
219.	SS	((Laughter))	Embarrassed laughter.	NELAB	
220.	S S	What are you trying to say? We are not really getting anywhere…	A student questions what he means and he explains	NELAB	

			he does not feel they are getting anywhere.		

CHAPTER 5 Findings

In this chapter I will discuss my findings in relation to communicative elements and contextual factors that enhanced and hindered elaborative dialogue in brainstorming in the PBL tutorials at Norwich Medical School. I provide background to the tutorial groups and I outline the different types of questions that the tutors used and the dialogue that followed. I outline the question types that were effective in enabling elaborative dialogue and those that were not.

Background to the tutorial groups

The 5 PBL groups were well established and the students had been working together for between 4 and 7 months. The participants were year 2 students in their late teens/early twenties at Norwich Medical School and their tutors were of varying ages and experience.

Room layout

The tutorials took place in the medical school. In each tutorial, the students sat in a circle round a central table upon which they placed their personal items; snacks, drinks, computers and paperwork. The PBL tutor and I sat with the students as integral members of the group. The tutorial rooms were equipped with a computer with internet connection, a projector, a whiteboard, a flip chart and pens.

Tutorial 1

PBL tutorial group 1 had been working together for 6 months. The PBL tutor was a general practitioner who was nearing retirement. He was significantly older than

the students. He had many years of experience as a PBL tutor. In addition to being a PBL tutor, he delivered communication skills teaching, seminars and lectures and also taught students in his general practice. He had no experience of learning in a PBL environment.

Tutorial 2

The students in group 2 had been working together for 7 months but the PBL tutor was new to the group. He had been working with the group for only a few weeks. The tutor was a Foundation Year 2 doctor (FY2) who had been qualified for 18 months. He was attached to the Norwich Medical School for 4 months of a 2 year postgraduate academic training scheme to gain experience in research and teaching. He had no experience of learning in a PBL environment and no prior experience of being a PBL tutor. He was a few years older than the students.

Tutorial 3

PBL tutorial group 3 had been working together, with the same tutor, for 4 months. The tutor was a medical student. He was a 5th year student at Norwich Medical School who was doing an intercalated degree in medical education. He had first-hand experience of studying as part of a PBL group but no previous experience of being a PBL tutor. He was a couple of years older than the students in the group.

Tutorial 4

The students in group 4 had been working together for 7 months but the PBL tutor was new to the group and had been working with them for only a few weeks. The tutor was a Foundation Year 2 (FY2) doctor who had been qualified for 18 months.

She was on the same academic training programme as tutor 2 and attached to the Norwich Medical School for 4 months of a 2 year postgraduate academic training scheme to gain experience in research and teaching. She had no prior experience of being a PBL tutor and had not had experience of being a student in a PBL group. She was a few years older than the students.

Tutorial 5

PBL tutorial group 5 had been working together for 5 months with the same tutor. The tutor was a mid-career hospital consultant. He had been a PBL tutor for a few years. In addition to this he taught medical students in lectures and seminars and in the hospital setting in ward rounds and in clinics. He was older than the students by a couple of decades.

Findings

I analysed the tutor's questions that preceded the elaborative and non-elaborative discourse. In my analysis I explored the purpose of the question, the turn-taking patterns, compliance with PBL and classroom rules, the academic content of the discussion (lexis) and the rules regarding allowable contributions.

I have classified the findings into three sections; non-elaborative discourse, elaborative discourse and unusual events.

Non-elaborative discourse

Questions with multiple parts

Tutorial 1

In this tutorial the tutor asked some questions that contained multiple parts without allowing time for the students to respond.

The tutor asked an open question '**Are there, are there any, anything there anyone doesn't understand?'** (line 138). He did not wait for an answer before continuing with two further questions. He shut down dialogue opportunities by saying the case was '**very straight forward'**. The tutor changed the word '**very**' to '**reasonably'**, but the sentence still implied that the tutor expected the students to understand the content. A student responded saying '**erm'** to signal that he wanted to take a turn, but the tutor continued with '**OK'** (with downwards intonation signifying a closing comment rather than a question) and the student accepted this. The tutor confirmed there were **'No terminology or issues there↓'** (down ward inflection) and moved on again saying **'Do you want to start us off (name)?**' The students complied with the polite instruction.

The tutor's question was initially open but became closed. It had two potential purposes, to explore what students already knew and/or to provide structure for the tutorial, but it achieved neither of these aims. The tutor possibly changed his mind while talking; first he offered to '**clarify'** things for the students then he said they would go through the case '**bit by bit'**. Maybe he became aware of my

presence in the room and recognised that it was not the PBL tutor's role to clarify things for students.

At the end of many of his turns, the tutor used a question with a tag; '**doesn't it**?' Questions with a tag create a pedagogical problem for students because the anticipated answer is implied in the question and the listener does not generally need to engage in higher cognitive processing. They generally result in agreement and confirmation by the listener that what the speaker has said is correct. If a powerful person uses a question tag, it is highly likely they will get agreement. My data suggested, by the verbal deference they showed to the tutor, that the students viewed him to be in a position of authority. They responded to the question with agreement. Brainstorming can be stressful for students who fear that their lack of knowledge will be exposed (Robinson 2011). In this sense, a question with a tag can provide advantage for the students as it offers an opportunity for contribution with low risk of error, but this is at the expense of higher order thinking.

In this tutorial extract, the turn-taking pattern followed the IRE classroom IRE pattern. The tutor was in charge and he controlled who spoke. The tutor had more frequent and longer turns than the students. The tutor expressed his right to talk for as long as he wanted without being interrupted. The students deferred to the tutor's authority and complied with his instructions. The tutor controlled and dominated the dialogue in this extract. The students listened and made minimal responses. There was no elaborative dialogue. The students and the tutor

demonstrated alignment to the normative classroom convention (Mehan 1979). This could relate to the previous experience in which it would be the tutor's duty to impart information to the students. This model was problematic in PBL at Norwich Medical School because the tutor was not a subject expert.

The theoretical purpose of brainstorming was to give students opportunities to think and talk about their existing knowledge and to identify knowledge gaps. Questioning can be used to encourage this. For this to be effective, time is needed after asking a question for cognitive processing to take place. The cognitive processing model formulated by Stahl highlighted the importance of actively processing stimuli within the first few seconds of receipt (Stahl 1994). Questions with multiple parts can therefore create a pedagogical problem for students.

Missed elaborative opportunity

Tutorial 2

In this extract the students spoke directly to each other but did not use elaborative dialogue and did not co-construct meaning.

The students referred to having previously covered topics *'***I know we've like touched on in the past'** and **'we've already done one on coroners and stuff'** (Line 594).

It was clear from their language that they had some knowledge, but they did not expand on this and the tutor did not challenge them to elaborate on it. The tutor let

them agree that it would '**be good to go over it again'** (line 597) without any discussion of their existing knowledge.

The general extender **'stuff'** was used frequently. A general extender indicates that a previous word is one of a set of similar things and that there is no need to expand or to be explicit as everybody is aware of what is meant (Pichler and Levey 2011). General extenders serve several purposes. In this extract the general extender was used to be vague. The students were identifying things that they had covered before but were possibly unable to recall completely. The students listed learning topics but made no attempt to explain what they already knew. The general extender helped them to avoid a specific discussion of knowledge of the subject. Its use constrained elaborative discussion.

General extenders can also be used to signal the end of a turn. The students self–regulated to some degree by use of the general extender as a signal of the end of their turn. The students spoke to each other and the dialogue was fast flowing without breaks between speakers. This is common in ordinary conversation but unusual in the classroom where there is usually tighter control over who speaks (Pichler and Levey 2011). The tutor did not intervene to direct the conversation or control who spoke. Multiple students spoke at once and interrupted each other. A superficial discussion took place about what had previously been covered and what should be covered next but there was no elaborative dialogue. The students did not challenge each other's ideas. They did not ask each other questions related to medical concepts.

General extenders can also be used to promote cohesion amongst speakers. Group cohesion was very important to the students who spent a lot of time together not only in the PBL session but also in other teaching sessions. The students generally agreed with each other and did not challenge any ideas put forward about things that had been covered previously. The general extender helped the students to communicate comfortably without a specific discussion of knowledge of the subject. It avoided exposure of ignorance, but its use constrained elaborative discussion.

The tutor did not guide the discussion to keep it intellectually responsible. He did not ask any exploratory questions. The tutor missed opportunities to intervene to facilitate the students to discuss elaborative dialogue (Paul and Elder 1997).

The example demonstrates, by its absence, the significant role that the tutor can have in guiding the dialogue in PBL brainstorming.

Long turns, vague questions

Tutorial 2

In this extract the tutor took a very long turn. He relayed a clinical anecdote relating to a patient who had been successfully resuscitated by a defibrillator that had been recently installed in a gym. The information delivery was disorganised. For example, the patient's age is usually the first thing that is presented but, on this occasion the tutor added the age at the end. He used medical terms that may have been unfamiliar to year 2 students and did not check if the students understood. The

tutor was not interrupted during the presentation, demonstrating the students' acceptance of his position of power. It was clear from his delivery that he had not prepared the presentation, it was without an obvious learning goal.

The tutor asked the students a question at the end of his long turn (line 694) '**…so anyway if he came in and so you'd got a man who died, had a renal transplant of ( ) what would you be suspecting as a cause, he's quite young he's 40.**

Despite the difficulty, the students attempted to answer the question demonstrating their conformity to the normative classroom rule that they are required to reply to tutor's questions. They suggested **'rejection'** and **'graft versus host'.** These were not the answers that the tutor was looking for. The tutor gave the students a clue to try to help; '**It's about electrolytes'** which helped a student to guess the answer **'high potassium'.** The tutor evaluated this as the correct answer and did not ask other students for their opinion. He did not ask the student to explain this further. He highlighted that **'electrolyte issues'** had been covered by one of the other students previously then moved away from that learning point.

Presentation of similar comparative cases can help students with contextualisation of information, but the tutor spoke at length without clear purpose. The students did not get a chance to communicate their ideas. There was no opportunity for the students to engage in elaborative dialogue. The tutor assumed the position of subject expert for the short time that he presented the case about which he had only limited knowledge. The turn-taking pattern resembled the IRE pattern.

Tutors should be advised that in the same way that preparation is needed for teaching, it is also useful to prepare to facilitate a PBL session. Spontaneity can add interest and variety but can also result in lack of clarity. Long, unfocused, badly worded monologues can lead to a poor learning environment. Long tutor turns can make it difficult for students to actively engage in the learning experience. Tutors should be advised to keep input to a minimum and make sure that input has a clear purpose. Planning and preparation in advance can improve the quality of the questions asked.

Hypophora

Tutorial 1

The tutor asked the students '**what do you think heart racing means**? (Line 1156). It was an open question addressed to the whole group. A student responded questioningly **'palpitations?'** The student directed his answer to the tutor, not to the other students. The tutor did not ask the student to elaborate or ask for any other students' opinions. The tutor implied that there were a variety of different ways of describing the symptom of heart racing but did not ask for further students' ideas. The tutor explained what the student thought was meant by heart racing. There was no elaborative dialogue.

The tutor asked, '**What do you think? Does that sound cardiac to you?'** (Line 1166). A student replied '**vertebrobasilar insufficiency'.** The tutor did not ask the student to explain the answer in any further detail. Some of the students may have not previously heard the medical term. The tutor spoke again and explained his

thinking, but he was not very clear. '**Yes, it does doesn't it? It's more like we've talked about with strokes and things'.** Possibly other students did not know the answer to the question, but it is more likely that the tutor did not wait long enough for the students to think and reply. The students may have been familiar with the tutor's question style and been aware that if they sat quietly, the tutor would provide an answer. Possibly, as an observer, I affected students' usual dialogue pattern and they felt more inhibited to reply.

The tutor may have considered it was clearer or quicker to explain things to the students rather than let them come up with different explanations. Alternatively, the tutor's concern may have been fear of silence. Silence is something that can feel awkward to some. Answering one's own question is a way to avoid silence. Answering one's own questions also reduces the chance that the students could ask questions of the tutor. The tutor, as a non-expert, might worry about his own lack of knowledge. A question with a tag can signal that the person using it is not quite sure about what they are saying and is seeking reassurance from the listener.

The tutor dominated and controlled the conversation. He determined the topic of conversation, who spoke and for how long. The dialogue pattern followed a typical IRE norm. There was asymmetry between the length of time that the tutor spoke and the length of time the students spoke. The tutor completed several sentences in the course of his turns. The student's response was a single word. The tutor was probably unaware of the type of questions he was asking. He may have been able to offer some insight if he listened to the audio recording. This type of further

analysis might be of interest to shed light on his thought processes and reasons for use of the questions, but it is beyond the scope of this research project.

What can be seen from my data is that the tutor's use of a question that did not provide opportunity for students to respond, did not result in elaborative dialogue and probably reduced the opportunity for students to engage in higher order thinking. Questions with multiple parts, question tags and hypophora should be avoided in brainstorming in PBL.

Interruptions

Tutorial 4

In this tutorial, the tutor was engaged in discussion with the students, but asked unclear questions and interrupted the students. For example, '**OK, Right, so out of that first initial bit, (0.2) so he comes in with palpitations…dizziness. So, what do you think? (0.4)'** Line 1596). The tutor directed the question to the whole group. Several students responded and overlapped with each other contributing different ideas; some were talking about what might be wrong with the patient, others on what subjects they should focus on that week. The tutor repeated some of the words that she heard students use, for example '**arrhythmias'**, but she did not ask the students to elaborate further on what they were saying or explain what they were thinking. She tried to draw their contributions together '**Right, so we've got an umbrella term of arrhythmias. So, you said ventricular arrhythmias and supraventricular (0.4) Anything else… that's going on there? (2)' (line 1608).** This question was also vague, and it did not focus the discussion. The tutor got no

response and after a 0.4 second pause, she added '**that's going on there?**' The students were quiet. Much has been written in the education literature about wait time and its use in the classroom. This tutor waited for a response, but none was forthcoming. The students may have been trying to work out the answer to the question – or possibly the meaning of the question.

A student suggested '**cardioversion?'** in a questioning tone. That was not the response the tutor was looking for. The tutor highlighted she was talking about '**In that initial bit'**, but it was not clear what she meant. A student began to explain his understanding of the principles of management of arrhythmias, but the tutor cut in.

1611S **Rate control and rhythm control 'cos you've got to manage the, the rhythm but also the kind of rate control… you then - he's given beta' blockers as well...so, rate control**

1613T OK, anything else to add to that initial bit? The only thing is I think is do you remember in the past we've talked about stuff that is like very acute. So is that patient well or unwell?

The tutor changed the topic back to her own agenda. She was trying to get the students to think about something else. The question she used was very unclear. The tutor also asked further questions and ended on a closed question.

It would have been more useful if the tutor had listened to what the student was saying, encouraged him to finish his explanation and then asked other students about their understanding of the management of arrhythmias. Arrhythmia

management is a difficult subject. The students (and possibly the tutor) would be likely to have knowledge deficits. Through discussion, students could have explored their existing limit of understanding, reached their learning edge and then created a learning objective to research the topic further.

Tutors need to be aware that it is important for the facilitator to listen to the students and ask the right question at the right time. In PBL it is not possible or appropriate for the tutor to prepare all the questions in advance. Tutors need to encourage students to ask questions. Flexibility needs to be used to allow the conversation to take unexpected turns. The tutor needs to be able to judge if the discussion is academically relevant and keep the conversation intellectually responsible. Tutors should not interrupt students to continue with their own line of thinking when the students are explaining their thought processes.

In the IRE classroom, the right and obligation to take the next turn lies with the teacher (Ingram and Elliott 2014). If the PBL tutor uses this model, it is important for the tutor to be aware that processing time is needed during and after a student has finished answering a question. When students answer questions, they may pause to think. If the tutor interrupts by asking another question, the student is deprived of the opportunity to develop a complete answer to a question or to correct errors that may have been made. Interruptions of this type can have a disruptive effect on cognitive activity and therefore impair learning. If teachers can refrain from speaking until 3 to 5 seconds have elapsed, a student may continue to speak, or another student might commence to speak.

Multiple responses

A feature common to several tutorials was the difficulty that tutors had in dealing with multiple responses from students. In my data there were a few examples in which the students spoke over each other in response to the tutor's question and it was impossible to hear what was being said. For example, in Tutorial 4 the tutor asked:

1624 What's that paragraph kind of… for?

Many students responded and the tutor indicated that she was listening, but she was not able to hear everything that they said. The tutor tried to summarise, but there were too many view points for this to be effective. In contrast to the IRE classroom dialogue norm in which students wait to be nominated by the tutor to respond, the students were free to self-select and did not have to raise a hand to wait for permission to speak. The students directed their answers to the tutor, but the tutor did not control the replies. Throwing a question to the whole group can be an effective questioning strategy if there is a generally agreed single answer, but it can be less useful in situations in which there are multiple responses due to multiple opinions.

A reparative technique is needed when the dialogue pattern gets out of control or goes wrong (McHoul 1978). The reparative technique that the tutor used in this example was to take back control of the dialogue and dominate the talk. There are better ways of managing multiple responses in the classroom. Asking students to raise a hand is the usual way in the IRE classroom, but another possibility in a less

formal setting is to simply ask students to talk one at a time. As an alternative, students could be asked to talk to their neighbour and then present back to the group. Another strategy is to ask students to write down their answer so that all students are thinking, and then one or more can be chosen to present opinions. Alternative methods would have provided a better opportunity for the students to continue to express their ideas. The tutor was possibly unaware of the problem or the solution.

Managing the dialogue is an important aspect of managing the PBL group. Tutors need to have some awareness of ways in which this can be done. Tutors should be encouraged to reflect on the dialogue patterns that occur in their tutorials and find ways in which to encourage the students to talk to each other rather than to direct all responses back to the tutor. It is important to control the dialogue so that contributions are not lost.

Closed questions

Tutorial 4

In this extract, the tutor tried to help the students to organise what to learn by asking the students questions about what they had covered previously. She also asked them what they thought they needed to cover next, but she did not ask them any questions about their actual knowledge or ask them to elaborate on any knowledge.

Line 1631 ‘**So do you know much about HOCM**?’

Line 1638 ‘**Have you covered that before? Congenital heart conditions?’**

The tutor asked the students whether they had covered congenital heart problems before, but did not ask them to elaborate on what they knew. At line 1629 she asked the students *if* they knew much about HOCM rather than *what* they knew about HOCM. The tutor did not know if the students had already studied HOCM. She used closed questions that could be answered with yes or no answers. The tutor did not ask the student to tell her what they knew about the condition and the students did not share any knowledge they had about HOCM. At line 1632 the tutor asked the students what the paragraph was **‘asking them to look at’**, referring to external control in a similar way to the students in extract 1 when they were working out what topics they should be studying, rather than identifying knowledge gaps.

The tutor asked a lot of questions and she was engaged in the dialogue process, but she did not get the students to share any knowledge. Her questions related to what they had covered before and what they needed to cover next. The tutor and the students indicated their understanding that the purpose of the scenario was to guide the students in their learning. There was no elaborative dialogue.

Closed questions are recognised in schools to be a barrier to elaborative discourse. School science teachers are advised that in the elicitation phase of a science lesson, their role is to discover what the children already know and that this is best done through use of open questions (Russell and Watt 1990). It is acknowledged that

there are some uses for closed questions in the classroom particularly for very young children, for whom, limiting choice of answer can provide scaffolding, but as children get older, they are able to engage with open questions that do not limit choice. The elicitation phase of a science lesson can be equated to the brainstorming process in PBL. Academically able medical students should be able to engage with open questions.

The tutors in my study were all doctors and would therefore have had some training in the use of open and closed questions in medical practice. Some of the tutors were also involved in communication skills teaching which involved training students in the use of open and closed questions when consulting with patients. These same skills can be transferred to the PBL classroom. The closed question **'Have you covered that before? Congenital heart disease?'** could be better phrased as, 'What do you already know about congenital heart disease?'

Increased use of open questions is something that the tutors could try to incorporate into their questioning style in PBL tutorials. The tutors could be advised to follow the advice given to secondary school science teachers; to begin by exploring students' level of knowledge by use of open questions. With training and reflection on practice, I am confident that tutors, whether or not they had prior training, would be able to develop their questioning skills in PBL. Audio recording their own tutorials or asking a peer reviewer to record the questions they asked would be ways that tutors could reflect upon, and develop their practice, to enhance their questioning skills.

Guessing what to learn

Tutorial 5

In this extract, the students were discussing what the topic of the week should be. Some thought it was '**hypertension week'** (line 76) others thought it was '**risk'** week (line 69). The students discussed what topics to learn. The students were trying to work out the topics to study for the week. They were unclear about whether they were supposed to learn about hypertension or not. The first student highlighted that there was clearly a lot about blood pressure, but the next student contradicted this by saying '**its RISK week'** (line 69). There was disagreement about whether they should learn blood pressure that week or not. A student was heard to insist very quietly '°**it's hypertension week**°' (line 76).

The students did not discuss existing knowledge about hypertension or risk factors for heart disease. Hypertension is, in fact, a risk factor for heart disease, but the students were not aware that both topics were to be studied that week. The tutor let the students talk and did not control who spoke. He intervened to clarify that they were going to talk about risk factors. The students had a superficial discussion about risk factors for heart disease. The lexis was not medical. They did not co-construct knowledge or share their understanding. They did not engage in elaborative dialogue.

A student asked '**How many questions do we need**' line 97 demonstrating his focus on getting through the process to get the right number of questions rather than,

actually thinking about the medical concepts or, attempting to have any discussion of knowledge.

The students and the tutor in this tutorial were suggesting, through dialogue, their understanding that the purpose of the scenario was as a guide to the curriculum.

Elaborative discourse

Extension questions

Tutorial 3

In this tutorial the tutor used extension questions to enable students to verbalise their thought processes. Extension questions facilitated students to consider their existing knowledge and encouraged students to share this with the group.

A student was talking about the content of a PBL case to identify topics for the group to study. He mentioned the lecture series. The dialogue was not elaborative; the student did not contribute his knowledge or understanding of the topics. The other students initially joined in with contributions related to identification of topics to study. A student mentioned that something could '**mess up the INR'** (line 48) and the tutor asked an extension question about what '**else**' could change the INR (line 49). Students responded and continued with the new discussion topic. The purpose of the dialogue changed from '*what topic they were supposed to study*' to '*factors affecting the INR'*.

49 T What else can em, what else can (0.2) change their INR? (2.5)

The tutor steered the dialogue away from the fun but organisational conversation the students were having towards an academically challenging discussion. The tutor asked the student to identify something they already knew demonstrating his alignment with the idea that initial discussion of the PBL problem serves to activate students' prior knowledge and that this facilitates new knowledge acquisition (Schmidt 1993). Identifying existing knowledge requires higher order thinking. It is more difficult than organising a study list. Prior to the tutor's question, the conversation was a discussion of what topics they should cover demonstrating their alignment with the understanding that the purpose of the scenario was as a guide to the curriculum. By use of his question the tutor focused the students to think more deeply. The tutor's intervention was pivotal to altering the direction of the conversation from a façade of pretending to brainstorm to actually discussing the case. Through direct questioning, the tutor got the students to discuss their existing medical knowledge. As a result, the students had a meaningful medical dialogue and exchange of ideas about medical concepts.

The tutor thought about his phraseology as suggested by the pause during the sentence. His vocabulary connected his question to the student's previous discussion, and he repeated the same words that the students had used. The question was timed so as not to interrupt the students' discussion, it was short and precise, and the content was pitched at a level appropriate to the students' level of knowledge. The tutor waited 2.5 seconds after asking the question. During that

time, he did not repeat or reword the question. He remained silent and this allowed cognitive processing to take place (Rowe 1974).

54 T Is there anything other than drugs that can affect how effective warfarin is?

The tutor used another extension question at line 54. In response a student tentatively suggested **'Uh, there's dietary things I want to say CRANBERRY JUICE'**. The other students chimed together in response to confirm their view on cranberry juice. This demonstrated shared knowledge and understanding. The increased volume of her final suggestion of **'cranberry juice'** (line 55) in unison with the other students represented the cohesiveness of the group. Research into dietary factors affecting Warfarin is an area of medicine that is uncertain (NICE 2018).

Later in the tutorial, the significance of the student's response became more evident; the students had been on a hospital teaching placement where they met a patient who had been prescribed Warfarin and they saw he had a carton of cranberry juice by his bed. The students had not been sure what to do. There is some uncertainty about the interaction of cranberry juice with Warfarin in the medical literature. The tutor's questioning technique provided scaffolding to enable the students to negotiate information and share knowledge (Vygotsky 1978). When scaffolding was provided, the students were able to engage in dialogue with each other and come to a decision from their own point of view. It is increasingly important for students to be able to come to their own decisions as medical

knowledge continues to expand and conflicting information is published in medical research papers. The tutor did not give his point of view.

A student said Warfarin took **'ages to stop'** (line 61) but displayed uncertainty. His colleagues confirmed he was correct but did not elaborate. The tutor asked them how to '**manage someone'** who had a high INR. A student suggested '**less Warfarin?'** There was a brief silence. The tutor did not evaluate the answer. A student explained '**vitamin K like actually reverses**' [Warfarin] (line 69) and the student who had suggested '**less'** Warfarin demonstrated insight and understanding by saying '**Aha!'.**

At one line 69 there was an 'Aha moment'. An 'Aha moment' is a colloquial expression for the moment of insight or sudden comprehension which is usually associated with a good feeling. I scoured the data for another example but was disappointed. It was the only Aha moment identified. Of medical interest, a study using electroencephalography (EEG) and functional Magnetic Resonance Imaging (fMRI) of the brain has identified the neural correlates of the "Aha moment" (Kounios and Beeman 2009)

The turn-taking pattern in tutorial 3 was different to an IRE classroom dialogue in which the tutor evaluates students' responses and takes alternate turns. In this tutorial there was asymmetry with students dominating the turns and talk time. The dialogue rule was that any student could self-nominate to speak. Through discussion, students verbalised conceptual understanding of the case. Their lexis

contained medical terms; black stool, duodenal ulceration, Warfarin. They concluded that the patient might have bled from a duodenal ulcer because she was taking non-steroidal anti-inflammatory drugs and was on Warfarin. The tutor used only a few questions, but his intervention altered the goal orientation and purpose of the students' dialogue. The content of the tutor's questions was related to factual knowledge and the students responded to his questions by verbalising their knowledge.

The students performed elaborative dialogue; they shared knowledge. They asked and answered each other's questions, they verbalised conceptual understanding of ideas and acknowledged different opinions. They had a meaningful discussion about the patient's symptoms and signs and medical problems. The discussion had higher cognitive value. The tutor promoted and supported the elaborative dialogue by use of extension questions. He facilitated the dialogue to take place but did not dominate it. The tutor's questioning technique kept the discussion focused and intellectually responsible. Without the tutor's interventions, the students were not forthcoming in sharing their knowledge.

Dialogue control

Tutorial 3

The tutor used a closed question, '**So is this acute or is this chronic' (line 148).** He was possibly anticipating unanimous agreement of the response 'acute', but instead the students responded with the answer 'chronic' and began to talk over each other. Some dialogue was lost and difficult to hear.

The tutor intervened and took back the turn. He identified a comment half-made by one of the students and asked her to elaborate; **'What were you going to say about the MCV?'** (line 153)

The student explained her thinking but showed uncertainty by use of a questioning tone. The tutor did not explain or offer an explanation, but instead reminded the students of something they had covered in a previous tutorial. The group came to a consensus of agreement that the answer was **'Acute'** (line 157).

The turn-taking pattern was in some ways similar to an IRE classroom dialogue, but rather than providing the answer, the tutor supported the students to come to their own understanding. The tutor regulated who spoke. The tutor facilitated the students to engage in higher order thinking by providing scaffolding for their discussion, which helped them to express ideas and relate previous knowledge to the new case. He supported the students by regulating the dialogue when the students spoke over one another, he intervened to direct the dialogue and with the support of the tutor, the students verbalised conceptual understanding. The tutor's questioning style kept the discussion focused. He drew students into the dialogue, and he used a probing question to get further information and help the students to resolve the issue of whether the answer was acute or chronic.

Short questions

There were several examples to demonstrate that when the tutor asked short precise questions, the students' responses were elaborative. For example in tutorial 3.

Tutorial 3

In this segment the students' discussion was related to causes of falls. They talked about consequences of poorly controlled diabetes and the relationship this could have with falls.

In the opening sentence, a student commented that the patient was **'a fall risk'** (line 97) and other students agreed but did not elaborate on their thinking. The tutor asked a specific question:

97 T 'Why is she a fall risk?

The students gave several relevant responses.

271 T What's…what's a CURB score?

S That's respiratory?

A student suggested they work out the CURB score. The tutor questioned their knowledge of the CURB by using a direct knowledge recall question. The students recalled they had learned about the CURB previously in the respiratory module. They tried to recall what they knew. Between them they listed the components: confusion, urea, respiratory rate, blood pressure. They attempted to calculate the patient's score and realised they could not do it as the information they needed was not provided in the scenario. They recognised it was not relevant to calculate a CURB score as the patient did not have a diagnosis of pneumonia.

The tutor used a short precise question to explore students' knowledge. The students worked out for themselves that the CURB score was not relevant to the new case and demonstrated co-construction of knowledge. In these examples, the tutor's short precise question was followed by students' detailed explanations of understanding. The tutor facilitated the students to verbalise conceptual understanding.

If the tutor talks for a short time, there is more time for students to talk. There are additional pedagogic benefits to using short questions. Short precise questions followed by a pause can allow students to focus and think clearly without distraction and allow students to reach a higher cognitive level. The effect of short precise questions in my data are more evident when contrasted with the lengthy tutors' questions in Tutorial 4. The pace of the discussion and the contribution of the students are very different in the two extracts.

Wait time

Tutorial 3

The focus of the students' discussion was on blood tests they might order to help to make a diagnosis. The students were having fun as evidenced by laughter, but were not verbalising conceptual understanding. The tutor tried a minimal intervention '**uh huh'** (line 393) to get the students to concentrate on medical knowledge - but it did not work. The students did not elaborate so, he asked a direct question.

395 T What do you know about D-dimers? (3)

This specific question helped the students recall knowledge and consider the use of the D- Dimer. The question required depth of understanding and the tutor allowed students time to think. The students' explanations were slow and faltering. The tutor waited until a few students had completed explanations. He did not interrupt them. He remained silent. The students concluded about the use (or not) of the D-dimer test. The student dialogue pattern was initially fast paced with minimal breaks and interspersed with laughter in a social dialogue style. The tutor's intervention regulated the students' dialogue, which became slower, interspersed with pauses and reframing, demonstrating that they needed cognitive processing time. The slow response showed cognitive processing was taking place.

Tutors need to consider the reason for silence after a question has been asked. Pauses in speech can occur because of disengagement, not paying attention or not understanding the question, so tutors sometimes can feel uncomfortable about silence. Understanding the reason for the silences is a skill that requires the tutor to pay close attention to the students, be familiar with their level of knowledge and additional cues can be used, for example, observation of facial expressions which might display confusion, concentration or boredom. These skills could be developed by tutors with practice and self-reflection and could be developed by recording one's own tutorials and analysing effective and ineffective questions.

The IRE classroom rules give the tutor the right to speak for as long and as often as s/he wants. My data suggested this was also the case in the PBL class and the students deferred to the tutor. This means that the tutor can also choose not to

speak and remain deliberately silent to allow cognitive processing to take place. It is important to try and recognise why silence has occurred because, if a tutor interrupts silence that is due to cognitive processing, cognitive activity can be disrupted and impair learning.

It has been suggested that if teachers can refrain from speaking for 3 to 5 seconds, a student may speak. In addition, if the student has stopped speaking, the student may continue to speak, or another student might commence to speak. When average wait is greater than 3 seconds, changes in teacher and student discourse have been observed (Fowler 1975) and as wait-time is increased, the number of student-to-student interactions is increased. In addition, with longer wait time, students spontaneously initiate a greater number of statements, make fewer inferences and interrupt the previous speaker less frequently. Research has also demonstrated that increased wait time can result in higher cognitive level achievement in elementary, middle, and high school science. Wait time appears to facilitate higher cognitive level learning by providing teachers and students with additional time to think. This has not been previously demonstrated but could apply in PBL. The length of a pause between the question and answer is related to the difficulty of the question. Pauses are related to cognitive processing and if a student is being asked to explain something complex, greater cognitive activity is required and it should be anticipated that the thinking time will be longer *(Rochester 1973)*.

The tutor's short specific question in this tutorial, followed by the pause, refocused the discussion and facilitated the students to use elaborative dialogue and explain

their conceptual understanding to one another. The students responded to the tutor's request for knowledge, demonstrating compliance, and they gave explanations of their conceptual understanding of the use of the D-dimer in practice. The tutor kept the discussion focused, intellectually responsible and drew students into the discussion. There was elaborative discourse.

Minimal response

If silence occurs, students can sometimes be persuaded to respond if they are given encouragement that does not distract their thought processes. One tutor demonstrated encouragement by the use of minimal responses for example 'mmm'. Tutorial 3:

100 S and diabetes, and she's partially sighted (0.5)

T mmm, yeh… (0.5)

The tutor gently encouraged discussion and the students continued with the point. Use of this seemingly innocuous intervention was powerful and able to stimulate the students to produce effective collaborative dialogue and co- construct knowledge and understanding.

105 s diabetes shouldn't make you partially sighted [so I'm guessing

Yeh, (0.4) it can=

106 s =yes it can

The disagreement in this example led to a discussion about complications of diabetes. The tutor's intervention, though very brief, encouraged the students to think further about diabetes and to verbalise their thoughts. Engagement in disagreement is an important aspect of learning and can lead to higher order thinking. Identification of conflicting information was a rare occurrence in the student dialogue. The tutor supported the students to engage in higher-level discussion with greater cognitive reward. The tutor's use of the minimal response signalled that he was paying attention to the contributions. It enabled him to take part in the dialogue without dominating the discussion. The tutor may have used other non-verbal mechanisms to highlight his interest in the group, for example, eye contact, nodding or facial gestures not captured on audiotape.

The tutor initiated the discussion topic. The students elaborated in response to the tutor's question and verbalised their conceptual understanding of the causes of falls and poorly controlled diabetes. They questioned each other and turn taking was primarily between the students who communicated directly with each other. The tutor was relatively quiet after having initiated the discussion and, supported the dialogue further by use of minimal interventions, but did not evaluate the students' responses or adjudicate at a point of disagreement. The students recognised and conformed to a different classroom norm in which they could contribute spontaneously and talk to each other, but they complied with the tutor when he intervened, demonstrating they recognised the tutor was in authority.

The minimal response technique is not unique to PBL facilitation. It is used in everyday conversation for a variety of reasons and can be subconscious. It is also a technique taught to General Practitioners in order to help patients to open up when talking about difficult subjects. My data has identified that minimal responses can also be used as a subtle but useful technique in keeping the students focused in a PBL case discussion.

Unusual events

Laughter

Tutorial 3

At line 46 the student made references to someone not present identified as 'they'. '**I think they're getting at'** and '**they said stroke'** probably referring to the writer of the case scenario or the module team. It indicated that the students were thinking about what someone else intended for them to study rather than their own learning needs. The student highlighted that there '**should have'** been a lecture that **'didn't happen'** (line 46). This illuminated the importance of the lecture series for the students for them to identify what they needed to learn.

The conclusion that the student came to; that it might be a good idea to '**go over clotting',** made the other students respond with mirth and, the joke continued with an ironic **'yep, that's the one!'** and, another student's contribution of a mock question '**coagula↓tion↑ cascade?'** This language suggested group cohesion as they shared an insider joke; the idea that they identify their learning needs from

the scenario was ludicrous. With the understanding and recognition that the PBL curriculum had been designed to help the students to identify their knowledge gaps and be able to direct their own learning to fill these gaps (Towle 1991) this, was of concern. The remarks and behaviour may have been deliberately played out for my benefit as head of PBL.

Whispering and whistling

Tutorial 5

A student asked a question **'Isn't there a week on blood pressure?'** (Line 188). This was followed by an unusual response, laughter and whistling. The laughter represented the other students' discomfort with the violation of the tacit PBL rule that; the students were not allowed to ask about the learning outcomes: they should be able to work out what they needed to know from the PBL case. The other students whispered. I was not able to hear what they said. The student persisted with her question and asked; '**is there a week on blood pressure or not?**' The other students continued whispering and there was some whistling. The students did not answer the question. The tutor did not answer the question. Students moved on quickly and changed the subject. They asked, '**Do we need to go over ace inhibitors and calcium channel' 'Do we need to do Warfarin again?** (line 191).

The vignette provided evidence of the difficulty that the students experienced reconciling PBL ideology with their need to fulfil the requirements of the course and pass exams in specific subjects and a predetermined level of competence. The original pedagogical idea for PBL as a self-directed learning process in which,

individuals were expected to take the initiative without the help of others in diagnosing their learning needs, formulating goals, identifying human and material resources, and evaluating learning outcomes (Knowles 1975, Distlehorst and Barrows 1982), was clearly a challenge for students who needed to organise their learning to fit in with the medical school curriculum and examination system. The necessity for students to be self-directed to identify their knowledge gaps and be able to direct their own learning to fill these gaps (Towle 1991) had been something that it was felt was important for medical students in the 21st century. Ultimately the interpretation by students was different; they saw that the purpose of brainstorming was to identify the predetermined hidden faculty learning outcomes list. This prevented elaborative discussion of knowledge.

Summary

In summary, these examples suggested that, tutors played a significant role in directing the conversation. It is possible to see that when tutors used short questions, extension questions, minimal responses and silence, they were able to encourage students to engage in useful discussion with each other. The students responded to effective interventions and there were examples in which they shared knowledge with each other. There were a number of very powerful interventions in tutorial 3 in which the tutor directed the conversation, but he did not dominate the conversation. He managed to keep the discussion focused and intellectually challenging. He stimulated the discussion with probing questions and drew students in. The tutor was important in enabling effective dialogue. In these examples of

elaborative dialogue, the tutor was in control. He allowed the turn-taking pattern to differ from the IRE classroom norm so that students could self-select to reply to questions. The tutor waited for several students to express opinions. The students could direct questions and answers to each other and, to evaluate each other's responses. The tutor encouraged the students to talk to each other. When they spoke over each other the tutor regulated the dialogue. The tutor initiated topics of conversation and kept the discussion focused on certain issues. The tutor stimulated discussion and encouraged elaborative dialogue by use of wait time and extension questions. He drew students into the conversation by asking recall questions and supported students' contributions by minimal responses. When the tutor spoke, he used short precise questions with a clear intention. When students spoke, the tutor listened. The tutor enhanced the dialogue by his interventions without which, elaborative dialogue may not have taken place and learning opportunities may have been lost.

In the other tutorials, there were examples in which tutors did not intervene with appropriate questions and the students defaulted to social dialogue; they spoke over each other and they did not engage in elaborative discussion of their medical knowledge.

CHAPTER 6 Discussion

In this chapter, I offer some explanation for the findings from my research. My data demonstrates diversity in dialogue quality in PBL tutorials. Despite the student-centred design of the PBL method, the tutor had significant influence in the dialogue. From my analysis of the data and my position as a PBL tutor, I offer explanations for these findings. I consider the strengths and weaknesses of the research method I used, and highlight ways in which my findings challenge theoretical claims about the unique pedagogy of PBL. I will discuss the limitations of my research and describe ways in which my research findings and methods can be replicated by others wishing to improve communication in PBL tutorials.

PBL philosophy

Problem based learning was designed to be a student-centred learning environment (Barrows and Tamblyn 1980). At Norwich Medical School, PBL was set up to be student led. Students were assigned the role of 'chair' and 'scribe' for each tutorial. The student-led design of the tutorial structure was further signalled by the physical layout of the classroom. The tutor, instead of standing in the position of authority at the front of the class, sat amongst the students as an equal. Tutors were aware of the need to consider students' wishes and to take into account their ideas, concerns and expectations in relation to how sessions should be run. The aim of brainstorming in PBL at Norwich Medical School was to enable students to

discuss their existing knowledge and identify gaps in knowledge for further study through dialogue.

Student led dialogue

My data suggested that when students led dialogue in PBL brainstorming, they experienced several difficulties. The circumstances of PBL require students to communicate directly with each other to discuss their existing knowledge and identify further learning needs. The content of the student led discussions was frequently disorganised and centred on organising what to learn rather than exploring existing knowledge. Elaborative dialogue rarely occurred. In the following section, I offer explanations for these findings and guidance in order to overcome barriers to elaborative discourse in PBL.

Social dialogue

When the students led the dialogue in PBL the dialogue flowed without silences; speakers continued on from one another with minimal pauses and often multiple conversations took place at the same time. This is typical in social conversation (Drew 2005). In social conversation, it is not necessarily important for everyone to hear everything that is said; things can even be said about members of the group without all members hearing. When students regulated their own dialogue in PBL brainstorming, this type of social conversation occurred. It made transcription very difficult. On occasion, it was impossible to hear what was said, even when the tape was slowed down, because multiple conversations were occurring at the same time

and students spoke over one another. The voice of the student chair was difficult to identify, and the student chair did not regulate the dialogue.

Social conversation is, for most people, easier to engage in than academic conversation that requires knowledge and concentration. The students were sometimes tired, especially if brainstorming came at the end of the tutorial, when students had already completed the reporting back phase, and had therefore been discussing and presenting medical information to each other for over an hour. This may have been a reason that the students defaulted to this pattern, but the Norwich Medical School students were, like most medical students, very diligent learners. Many medical students have a vocation to be a doctor, and with fees in excess of £9000 a year, they were intent on the goal of qualification as a doctor, which required intense academic study for many years. Students were willing and motivated to work hard but when left to self-regulate, did not engage in effective academic conversation. In all interactions, there are tacit rules governing who can speak, when and for how long. The data revealed reasons for social dialogue to be more complex than simply taking an easy path.

Leadership

One of the reasons that the dialogue was social and ineffective in terms of elaborative dialogue in brainstorming was because of lack of leadership. The student chairs were supposed to lead the group but they were ineffective in the role. The voice of the student chair was difficult to identify. Students did not defer to the authority when the student chair spoke.

A difficulty for the students was that the role of chair rotated round the group. The frequent change in leadership made it challenging for the students to take charge. It was difficult for students to get used to each new chair who naturally would have a slightly different style. In addition, rotation of the role of chair meant that each student had only a couple of opportunities in the role each academic year. This made it hard to build on any experience gained.

Added to these problems was the fact there was also a tutor in the room, which made the role of the chair less clear. When conversations got chaotic through lack of leadership from the student chair, the tutor sometimes intervened and the students deferred to the tutor. Though tutors sat amongst the students to demonstrate their equality, the students verified through dialogue that they viewed the tutor to be in charge; when the tutor spoke, the students stopped talking. The presence of the tutor partly undermined the authority of the student chair because it was not clear who should be in charge of the dialogue. My data suggested that the students deferred to the tutor's authority but not to the authority of the student chair. This made the role of the student chair very difficult.

The students received very little training in how to be an effective chair in PBL. At the time of the study, the students had a brief introduction to PBL in their first year at the medical school. Some students received guidance from their tutor, but there was little further training or support offered. Many of the students were school leavers and had few opportunities to acquire experience of chairing a meeting

beforehand. Chairing is a skill that requires training and practice. The students demonstrated lack of knowledge and skill in the role of chair.

In summary, students did not demonstrate leadership skills to take on the role of chair. The presence of the tutor made the leadership role more complicated. In order to undertake the role of chair effectively, the students needed more training and support and a better understanding of the role.

Deference

Students showed deference to the tutor because the tutor had power. Tutors were, in general, older and more knowledgeable than the students. Tutors also had the powerful position of reporting student absences. Attendance at PBL was compulsory for students. It was a requirement of medical schools to demonstrate to the General Medical Council that the students had attended a minimum of 80% attendance on the undergraduate course. If a student was missing from a PBL tutorial on more than two occasions in one term, the tutor was instructed to grade the student with 'Needs Improvement.' Three absences in one term warranted an 'Unsatisfactory' grade. At the end of each module, tutors were asked to provide a progress report, similar to a school report. The intended purpose of the PBL report was to direct and support the students in their learning, but with the addition of the attendance record, it also provided an assessment of the students' professional behaviour in PBL. Demonstration of professionalism was something that was of vital importance to the medical students who, upon graduation, had to demonstrate professionalism to the General Medical Council in order to be given a licence to

practice. Without a licence, a student could not work as a doctor. The medical school was required to provide a report to the GMC for each student on completion of training, which took account of reports from tutors over the five-year period across all domains. Students placed great importance on these reports.

Training was given to the tutors in relation to the standards of professionalism expected of medical students but some tutors were more stringent than others and the reports reflected individual tutors' opinions. In this way, the tutor held power. Students were aware of the possible significant consequences on their career if unprofessional behaviour in PBL was reported. Students' academic attainment was assessed more formally in exams which were subject to standard setting, validity and reliability measures; OSCEs or Objective Structured Clinical Exams and a written exam.

In summary, the students percieved that the tutor had power and authority in the PBL tutorial and demonstrated this through the deferential dialogue pattern. In contrast, the student chair who was supposed to lead the tutorial held little power or authority.

Social relationships

Another factor that influenced the dialogue in PBL was the significance that students attached to social relationships with their peers in the group. When people converse socially, they are performing an action that has meaning. Social conversation has the ultimate goal of bonding, friendship and establishment of social ties (Drew and Heritage 1992, Koester 2004).

Training to be a doctor requires long hours of study for many years. It can also be stressful. Medical students spend five years together in medical school and doctors have a close-knit community. Many doctors build relationships for life while at medical school. Relationships are built in part by social dialogue. My data suggests that the students recognised the importance of the need to build positive relationships with their peers. In Norwich Medical School, students were in the same group for many of their tutorials. The same group of students worked together in PBL, consultation skills and General Practice placements. This meant they spent many hours in each other's company, sometimes in small confined spaces such as a minibus in which they travelled to General Practice placements. A social hierarchy shaped within the group. Relationships were developed and sometimes broken within groups over the course of the academic year. Tutors did not necessarily have the insider's perspective on these group dynamics because they met the students for only three hours a week.

The data suggested students attached great importance to the social bonds within the group and revealed possible anxiety about damaging them. In the role of chair, students were asked to put themselves in the position of authority above other students. This put them in a position of possible social embarrassment to themselves or a colleague. My data supported the concept of 'Face Threat Act' (Robinson 2011) which explains internal anxieties that students face in PBL, including fear of losing one's own face in front of peers by exposing lack of knowledge, but also fear of exposing others' lack of knowledge. Robinson identified

that certain discussion activities including challenging other's knowledge, correcting an incorrectly stated fact and contradicting were of higher face threat than others. Social dialogue is usually of low threat and could be the reason Norwich Medical School students defaulted to this position.

In summary, students indicated they valued being a member of a cohesive PBL group. Interpersonal relationships between students were not always possible for the PBL tutor to see but were known by group members and could impact dialogue. Students were aware of their position in the group and valued the support that a well-functioning group provided. Friendship and support are essential coping mechanisms at times of stress. These factors influenced students' willingness to question each other's knowledge.

Conformity

Students' willingness to question each other was also possibly influenced by familiarity with IRE classroom norms. Students had had many years of previous experience in an IRE educational environment. Students were familiar with the idea that it was the teacher's job, not the student's job, to ask the questions in an educational setting. Research from school classrooms shows the majority of questions are asked by the teachers. The questioning style that teachers use in the IRE classroom is to ask questions to which they already know the answer and the purpose of the teacher's questions is often to find out if the students also know the answer. This was supposed to be different in the PBL class, chiefly because the tutors were not experts, but unless this was explicitly highlighted to the students,

they may have been unaware of this difference. Students may have assumed that the tutors would ask and answer questions and hold subject knowledge in the way their schoolteachers did. The medical students, particularly early in their training, were not aware of the breadth of medicine, so they may have been unaware it would not be possible for the tutor to have all the answers to questions.

The PBL learning environment was designed to function with a different set of classroom dialogue rules; the students were expected to ask each other questions to which they did not know the answer. My data highlighted procedural difficulties with the different dialogue pattern in which any student could ask a question. Because of the numbers of students, in order for a student to ask a question, a system was needed where each student could know when it is his or her turn, otherwise too many students would talk at once. My data highlighted that when the new dialogue pattern was attempted there were difficulties with overlapping dialogue.

Deep-rooted tacit rules were ingrained in the students and the tutors through socialisation in the education system since nursery class. These were violated in the PBL classroom. Expectations of these PBL dialogue rules were not made clear to the students. Students suggested that the change from the usual IRE classroom normative cycle of teacher: student: teacher dialogue pattern was difficult for them to adjust to. It is also anti-normative to display ignorance in an educational setting. From a young age, students are expected to demonstrate knowledge in the classroom and are rewarded for answering questions correctly.

Compliance

Students demonstrated they recognised the importance of compliance with the PBL process. What also became apparent was that students found the PBL process in brainstorming difficult and unhelpful for their learning needs.

The pedagogical idea for brain storming at Norwich Medical School was to help students to identify existing knowledge by thinking about the case, to share this knowledge with others and to use it as a platform upon which to build further knowledge. At the time of the study, tutors were told they should guide the students to identify the key issues related to each PBL case. Key issues for each PBL case had been derived by the medical school and written as a list of 'PBL Learning Outcomes'. The list was given to the tutors, but not the students. The rationale behind this was that it was considered important to help students be able to recognise their own learning needs in line with the recommendations from the GMC who had called for medical schools to reduce factual load and encourage students to develop their skills in directing their own learning (GMC 1993). The Kingsfund advised that the doctors of the future needed to be able to identify their knowledge gaps and be able to direct their own learning to fill these gaps (Towle 1991). It was thought that if the students had the list of learning outcomes it might stop them from thinking. What was apparent from the data was the difficulty that this guidance caused both the students and the tutors.

My data revealed that the students' interpretation of the purpose of brainstorming was to enable them to identify the predetermined faculty learning outcomes.

Students were aware that teaching activities and events for the week were timetabled to fit with the PBL learning outcomes. In addition, the written assessments were blueprinted against the PBL learning outcomes. Inevitably, once students became aware of this, they wanted the list of PBL learning outcomes. My data demonstrated that students were particularly concerned about getting the learning outcome list for the 'right week'. This was important because it enabled them to study particular subjects alongside the lecture series and the corresponding teaching on that topic. As strategic learners, they found ways round the difficulties. Sometimes the students looked at the lecture series in order to decide what to learn, for example, in Tutorial 1; ***'So, I'm thinking, going on the lecture that we had, that, what we were supposed to have but didn't happen'.***

Another way students acquired the learning outcomes was through a 'black-market.' 'Black-market' learning outcome lists were passed down from students in previous year groups, but access to the black-market could be tricky as not all students were willing to engage in the process. Also, the learning outcomes might have changed from one year to the next, meaning students could not be completely certain their list was correct. Of course, this practice was not officially allowed, so students did not want to convey to the tutor if they had the list. This made life very challenging for students and conversation in brainstorming was quite unusual because if they had access to the learning outcomes list, students still tried to appear to be trying to brainstorm and derive learning needs from the PBL case, but at the same time they also needed to check the accuracy of the list they had. This

situation was played out in Tutorial 5 in which the students were not sure which 'week' they were supposed to study.

The students spoke in whispers (line 76) to each other which was picked up on the tape when slowed down, but was probably not heard by the tutor. I certainly did not hear it when in the room. There was confusion about whether they should study 'risk' or 'hypertension' that week. The students continued to discuss this very quietly amongst themselves but without resolution. In tutorial 5 line 189 one student asked directly about the learning outcomes for the week. The discomfort this produced was demonstrated by laughter, further whispering and whistling by the other students. Clearly the student knew they needed to study blood pressure at some stage in the medical undergraduate curriculum. The purpose of this student's question was to find out whether blood pressure was to be studied that week or another week. The response from the students and the tutor were evidence that this question was 'not allowed'. Nobody answered the question.

As it happened, 'blood pressure' (hypertension) was part of the 'cardiovascular risk' week so it was a topic to be studied by the students that week. The students were not aware of this and remained unsure about whether they needed to study blood pressure that week or not. The discussion continued without depth or exploration of knowledge.

Necessity to make sure they got the correct list of learning outcomes limited the students from engaging in elaborative dialogue using their existing knowledge. The

students could not think past the question ‘is this a learning outcome for this week or not’? The withholding of the learning outcomes from the students did not produce the desired ‘thinking’ about medical knowledge that it was intended to promote. The students found ways round it. The talk was dominated by organisational issues of what to learn that week rather than about issues related to medical concepts. Organisation and discussion about what to learn rather than discussion of medical knowledge was also of lower threat.

It transpired that hiding the Learning Outcome list, whilst designed with good intent to help the students think, had the opposite effect. It made students think less about the case and more about how to get the list by way of subterfuge and resulted in superficial discussion of knowledge. It did not produce elaborative discourse; it produced confusion, secrecy and superficial dialogue. Students were restricted in the ability to be self-directed due to the prescriptive nature of the curriculum in the UK in 2018 in which students needed to demonstrate attainment of specific standards. Regulation of medical schools in 1960s Canada was different to the standards required in 2018 by the GMC in Britain.

Summary

My data suggested that when students led the PBL sessions, they experienced a number of difficulties. The content of the student led discussions was frequently disorganised and centred on organising what to learn rather than exploring existing knowledge. Elaborative dialogue rarely occurred. Students demonstrated

awareness and respect for the rules of PBL and that compliance with social rules was important. Students were also aware of the authority of the tutor.

Tutor led dialogue

There needs to be a change in teachers' beliefs from knowledge imparter to conversation facilitator in order to be able to make the shift from teacher to PBL facilitator. This change of role is well described in the PBL literature and was part of the ethos of PBL at Norwich Medical School. It was incorporated into tutor guidelines and training and my research demonstrates that the tutors at Norwich Medical School had made the theoretical paradigm shift from didactic knowledge imparter to facilitator. Tutors demonstrated awareness of the need to allow students to lead PBL sessions by their actions. In contrast to the familiar classroom set up, in which the tutor sits at the front of the class and has power over who talks, tutors instead sat with the students as part of the group. They allowed the students to talk to each other, they promoted a more relaxed atmosphere and the rules were more relaxed than in the IRE classroom setting.

These relaxed rules however led to lack of clarity in dialogue, difficulty in turn-taking rubrics and dialogue challenges. If tutors did not take charge, students reverted to social dialogue, but when tutors did step in they frequently attempted to revert to the use of the IRE classroom dialogue pattern (Mehan 1979). This was problematic for a number of reasons. I will discuss why they used this dialogue pattern, the merits of the IRE and the difficulties that occurred with its use in PBL.

My data demonstrated that tutors struggled to promote elaborative dialogue in PBL brainstorming.

Tutors use of the IRE in PBL

Research demonstrates that teachers tend to teach as they were taught themselves (Irby 1996). The PBL tutors at Norwich Medical School had been exposed to many years of IRE teaching and the IRE represented the familiar classroom norm. The IRE classroom dialogue pattern is ubiquitous from nursery school through to college and medical schools are no exception. In addition, the IRE had been a learning method which had, for the tutors, been extremely successful as they had reached high academic standards. Four of the five tutors in my research had learned medicine in IRE medical schools. The tutor in my study who had experienced PBL as a learner was the most successful at creating elaborative dialogue between the students in PBL brainstorming. This data supports previous research that suggests teachers tend to teach in the way that they themselves had been taught and it highlights the importance of 'modelling' in developing the teacher's style.

The IRE and problems with use in PBL

The IRE became widespread in England in the late 19th century. It provided a cheap and efficient solution to the problem of delivering education to large numbers. This had become necessary following the 1870 Education Act (Parliament) which mandated delivery of education to all children. Thousands of children gained access to education for the first time. Prior to this, education was restricted to those who could afford it; books were inaccessible, very expensive and often written in Latin

or Greek. The Victorian classroom enabled knowledge to become available through the teacher who delivered information verbally and was often the only source of fact. The goal of the teaching was for the teacher to impart their knowledge to the students. The teaching style reflected this. Questioning was a popular method of gaining attention and imparting knowledge. The teacher would ask a question to which s/he knew the answer then evaluate the student's response, following which s/he would ask another question. In the IRE model, the majority of questions came from the teacher and the teacher spoke for the majority of the time (Mehan 1979, Mercer 1996).

The technologies of the 21st century now enable those who live in the Western world to be able to access information in ways other than through a teacher. Widespread access to knowledge can offer great advantage to the learner, but it can also have disadvantage. One issue is there is so much information that students struggle with information overload.

Plurality of knowledge

The problem of information overload is one of the reasons that it is important for students to discuss what they have read and learned. This way of learning is different to rote learning of facts but in the 21st century, the widespread availability of information via the Internet has enabled all, including non-trained people, including patients, to access information. This has opened up multiple interpretations of research findings. Knowledge is no longer restricted to the educated few with a classical education. This has changed the way that medical

knowledge is accepted and established. This in turn has had a profound effect on the way we practise medicine. Current medical practice emphasises the importance of the collaborative patient-doctor dialogue and joint decision-making.

Medical students and tutors come from a scientific background and scientific knowledge acquisition tends to lead to positivist epistemic beliefs in a single truth. The tutors and the students revealed some discomfort in adjusting to the plurality of medical knowledge. The idea that there can be different opinions in medicine was unsettling for students who just want to be 'told the answer' by the tutor, but it is essential for today's doctors to be able to know how to rapidly access ever changing information, evaluate the research, interpret the findings and negotiate knowledge with colleagues and also patients. These skills alongside knowledge acquisition can be developed in a small group learning environment if students are enabled to discuss knowledge and information with each other. This is prevented if the tutor steps in and takes over the dialogue.

The non-expert tutor

Medicine is a vast discipline and knowledge changes rapidly. Medically qualified tutors might have covered some of the material in their student days, which could have been learned some years previously, but knowledge in medicine goes rapidly out of date. Tutors had knowledge of things that fell within their own discipline but they were not expert on the topics of each tutorial. Doctors cannot easily keep up to date with information outside their subject area. In Norwich Medical School, we had over 100 tutors, made up of clinicians, research scientists and a range of allied

health professionals, such as midwives and physiotherapists. None of the medically qualified doctors, research scientists or allied health professionals who were tutors had expert knowledge. Much has been written on the advantages and disadvantages of the expert tutor in PBL. This is beyond the scope of this research project. We did not have expert tutors for a variety of reasons, including the way the timetable was organised, and large numbers of tutors would have been needed simultaneously, leaving nobody available to deliver clinical care.

Experts taught students in traditional ways: lectures, placements and practical sessions in other parts of the undergraduate curriculum. Access to knowledge was also available in other ways, for example, in journals, guidelines, books and the internet. The data demonstrated that on occasion the tutors were able to use their medical knowledge to answer students' questions, but at other times, they were not able to do so because of lack of subject knowledge.

It was not intended that the PBL tutor deliver knowledge in the PBL tutorial. The purpose of the PBL sessions was for the students to discuss knowledge *with each other* rather than listen to information delivery from a tutor, but tutors found it difficult to facilitate this and often made attempts at information delivery in spite of lack of expert knowledge.

Classroom authority, power and control

The tutors and students were familiar with the IRE classroom in which the tutor was in charge and took control of the dialogue. In that setting, the teacher's authority was, in part, determined by superior knowledge. In the PBL classroom, the students

were sometimes more knowledgeable than the tutor and in a better position to provide an evaluation of each other's contribution than the tutor. Tutors found themselves in the PBL classroom in the unusual situation of being 'in authority' without being 'an authority' on the subject matter. It appeared that the tutors were not completely comfortable in this role and reverted to familiar.

The PBL classroom was designed to be different. The classroom layout enabled students to see everybody rather than only the tutor's face and the back of the student in front. This signalled a different dialogue style and set of classroom rules, but it was not clear who was responsible for managing the dialogue. The student chair role rotated round the group week by week so all students had a chance to chair the session. The 'student chair' was often named and made explicit at the start of the session, but the data did not reveal examples in which any student chair was heard to actually 'chair' the discussion. The data uncovered the fact the student chair did not have power to manage the group or control the dialogue because the students did not defer to the chair when they spoke.

The tutors found it difficult to devolve power to the group. My data suggested that the students regarded the tutors to be in authority; there were many examples in the data in which the students deferred to the tutor. It is an important finding that the tutors had significant power to direct the tutorial. Tutors may not have been aware of the influence they had on the discussion pattern, but my data indicates that tutors have the power, with suitable interventional dialogue strategies, to make it possible to implement elaborative dialogue between learners.

In the IRE classroom, the dialogue rules had been very clear; students should speak only if nominated by a teacher and bid for a turn to speak if they felt they knew the answer to a tutor's question. Students should not talk unless invited to do so and only when they felt they knew the correct answer. The IRE has some pedagogic advantage in enabling the tutor to structure the session and give opportunity for all students to speak individually. Relaxation of the rules in PBL resulted in difficulties because no one kept tight control of the dialogue. There were many examples in the data demonstrating little control over who spoke. Consequently, many students spoke at once. If the tutors did not control who spoke, students spoke over each other. This made it difficult to follow the dialogue.

Tutor training deficits

The tutors used interventions that did not enable dialogue to take place between the learners in PBL tutorials. Tutors frequently attempted to use the familiar IRE. When tutors used this tight control of the turn-taking, it constrained students from exploring issues. However, devolving power to the student resulted in social conversation chaos. A different classroom structure and model was required. This needed to be initiated and maintained by the tutor as the students looked to the tutor for guidance. Tutors themselves needed specific guidance on how to do this.

Teacher training can affect practice and attitudes. Schoolteachers are required to undertake formal training (www.teach.gov.uk) and be able to demonstrate Qualified Teacher Status (www.gov.uk) before taking up a teaching post. The minimum teacher-training requirement in the UK is one year for a postgraduate

certificate of education (PCGE). Many teachers however train for three or four years to get a Bachelor's degree (BEd) or Master's degree (MEd) in Education. During the training, teachers have the opportunity to learn about education theory as well as explore different learning and teaching styles, and gain practical experience through supervision in placements. University lecturers, on the other hand, are not required to demonstrate training or qualification in teaching before taking up a Lecturer post: subject expertise is the essential requirement. In more recent years, there has been a push to encourage lecturers to gain educational qualifications, but these are usually optional and often gained after appointment and whilst 'on the job'.

At Norwich Medical School, it was obligatory for tutors to undergo an initial training session for PBL before taking on a group. At the time of the study, this requirement was half a day (around three hours) of training. The training session covered some educational theory relating to PBL along with practicalities of the post and some regulatory information with regards to student support and management. However, there was clearly very limited opportunity for tutors to gain any experience or practical skill in such a short time. No time was allocated to exploring issues related to dialogue patterns or effective questioning techniques in the classroom. Tutors tended to rely on knowledge of familiar classroom norms and did not alter their practice to fit with the new learning paradigm. Without any personal experience of alternative classroom dialogue models, and in the absence of specific training, it is not surprising that the tutors fell back on familiar classroom models of

teaching practice. The tutors did not receive training in how to support the student chair. The student chair did not receive adequate training in chairing to enable them to move to a position of authority in the group. This led to confusion about who was in charge of dialogue regulation.

The room was set up for a collaborative discussion between students, but in practice, the tutors frequently dominated dialogue. This prevented elaborative discourse between students. It was not a requirement for the PBL tutor to impart knowledge. However, this still occurred as teachers attempted to model familiar classroom dialogue patterns. The IRE classroom dialogue model is the one with which the students would be most familiar. It needs to be recognised that the IRE classroom discourse structure is the default position, so if the expectation is that the tutorial session is *not* going to proceed in this manner, this needs to be made explicit. Unless attention had been drawn to different classroom dialogue models, it is not something the students or the tutors were aware of. During informal discussions with students and tutors, there were no references to turn-taking patterns. Prior to undertaking the research project I, in spite of my interest in medical education, had not been aware of classroom dialogue patterns.

In summary, PBL requires a shift in ideas away from the IRE classroom. If this is not made explicit, the students are likely to expect the tutor to perform the usual teacher role.

Summary

The definition of PBL is very wide and there are many different models. One thing that models of PBL have in common is the shift in emphasis away from the didactic delivery of information from the expert towards the importance of self-conceptualisation of knowledge and collaboration through dialogue between learners. This necessitates a shift in role on the part of the tutor away from 'information giver' to 'facilitator of knowledge acquisition'. The purpose and particular circumstances of PBL call for a specific style of discourse on the part of both tutor and students.

Since Socrates exemplified their use, questions have been central to teaching and learning. Research has taken place in schools in order to develop models of practice to help teachers in the use of questioning in the education process, but less emphasis has been placed on research in communication in the university setting, and questioning practices in PBL have received little attention to date.

Questions can be used in the classroom for a number of different purposes: to promote students' thinking, to reveal the extent of students' factual knowledge, to encourage students to display understanding, to stimulate students to interact with new knowledge and/or to help students formulate a theory on a particular issue. They can also be used to help the tutor to monitor the progress of the session, to check understanding of the audience and also to assess students (Hartley, Gill et al. 2003). The theoretical purpose of the tutor's questions in brainstorming in PBL was

to promote higher order thinking and elaborative discourse between learners. Tutors demonstrated they struggled to achieve this.

My research highlighted the variable nature of the quality of communication that took place in brainstorming in PBL at Norwich Medical School. I identified communicative elements that tutors used to enhance elaborative dialogue: asking short clear questions, waiting for an answer, listening to students and controlling the dialogue. I also identified ineffective communicative elements: poorly phrased questions, talking too long, interrupting and also not keeping the dialogue academically relevant.

My findings reveal the importance that the tutors' interventions played in enhancement of the discussion which challenges the idea that the PBL problem itself can serve to engage students in discussion (Dolmans, Snellen-Balendong et al. 1997). It supports the idea the tutor plays an essential role in the quality dialogue and the effectiveness of the learning environment just as in the IRE classroom in which the teacher plays a vital role in learning. Considering the ineffective dialogue that occurred when the tutors did not use effective facilitation techniques highlights further evidence for this.

There have been many claims that PBL is superior to more traditional teaching methods in medical schools and education theory has been latterly applied to PBL. Barrows claimed that PBL worked by discover learning or self-directed learning (Barrows 1983). Schmidt describes how the process of PBL relates to two

theoretical hypotheses of how people learn: 1) the activation- elaboration hypothesis and 2) the situated-interest hypothesis (Schmidt, De Volder et al. 1989). The theoretical evidence is at variance with the findings of curriculum comparison studies that generally do not report PBL to have effects over and above conventional training. My thesis illuminates the role of a skilled tutor in order to achieve the learning potential of PBL. In addition, contextual factors need to be overcome in order for the students to be able to benefit from the learning opportunities. Left to their own devices, students at Norwich Medical School missed opportunities to learn from each other. The learning environment was enhanced by effective intervention by the tutor.

Suggestions for improvement in PBL

Norwich Medical School has been outstandingly successful in many ways. It is a vibrant and caring community of diligent learners. We have trained 1259 doctors in the last 10 years and have also been evaluated as producing doctors who are excellently prepared for practice (UEA 2017). In 2014 the Norwich Medical School was rated number one for producing the best-prepared doctors by the General Medical Council's national survey of foundation doctors GMC in 2013 (Monrouxe 2014). This is certainly something to be proud of but does not mean we should not look for ways in which we can advance further. My research has highlighted areas ripe for development.

The dichotomy between the philosophy of PBL and the realities of learning in a PBL curriculum were made evident in my research. When the Medical school was set

up, in line with the recommendations from the GMC and the King's fund, its aim was to provide undergraduates with key skills necessary for newly qualified doctors including the ability to direct their own learning (Towle 1991, GMC 1993). PBL was selected as a suitable learning method as it was promoted as enabling students to develop problem solving skills, identify their own learning needs and improve knowledge retention *(Barrows and Tamblyn 1980).*

The structure of the undergraduate curriculum was carefully designed. It was broken down into modules relating to different parts of the body and each week had a set of learning outcomes against which the students were assessed at the end of each module (UEA 2017). This gave the students a clear course structure, but it is not hard to see why the students struggled with the idea that they should direct their own learning and identify their own learning needs when these had already been beautifully organised for them.

We must consider how best to implement PBL in the curriculum in Norwich in 2018. We need to draw on its strengths and adapt it to our own environment. We need to focus less on the philosophy and more on exploring the learning needs of the students. We need to move forward and consider how to plan and implement PBL in the best way for our students. PBL is flexible. We do not have to use an idealised version. My data demonstrate that there are contextual challenges to overcome when implementing pedagogical processes into new environments. Curriculum designers need to be mindful that what works in one setting does not necessarily work in another.

We need to steer away from the idea that PBL is a superior pedagogy to other teaching and learning methods and accept that it is something that can be used in addition to other learning methods. There is very little that is unique in the PBL pedagogy. There are many effective teaching and learning methods. They all require careful planning and implementation. Lectures are helpful for learning if the content is interesting, relevant, and well delivered and books are useful if they are well written and students read them. All learning environments work better if staffed by enthusiasts and if the students engage. Students and tutors cannot expect PBL to work without effort being applied.

Brainstorming can be made effective, but the pedagogical advantage can only be achieved if effective communication is facilitated between learners. I hope my research goes some way to help tutors to engage students in meaningful elaborative dialogue in brainstorming in order to maximise the learning potential. The quality of the dialogue that takes place between students in brainstorming is the key to the effectiveness of the learning opportunity. The tutor has the power and responsibility to make this happen.

In order for this to happen, the tutors need more training in facilitation methods and to be encouraged to be self- reflective. In my research I have provided a method by which tutors can self-reflect. The importance of good communication cannot be underestimated. Verbal strategies to enhance communication in the PBL classroom are important in the same way that communication is important in

medical practice. The facilitator's role in PBL is of vital function in enabling the effective dialogue.

My research has provided insight into variability of PBL in terms of implementation, enactment and quality. Learning and teaching is an art and research methods that can illuminate best practice are vital if we are to be able to improve practice. The variability of PBL limits the value of outcomes based research. PBL has been used for over 60 years. It is pretty clear that it works. The issue to now focus on is how to make it work better.

CHAPTER 7 Conclusion

Purpose of the study

The purpose of my research was to find ways to improve brainstorming in PBL tutorials at Norwich Medical School. My research aims were to identify communicative elements that realise and hinder effective communication in brainstorming in PBL tutorials and examine contextual factors that prevent the use of effective communication in PBL. The research was designed to answer the question; what communicative strategies can be used by tutors to enhance elaborative dialogue between learners in Problem Based Learning tutorials?

My research brings together theoretical models of what makes PBL work, research from the education literature on effective classroom dialogue, and an analysis method from the field of linguistics that can be used to explore practice.

My research was inspired from a position of trying to improve the quality of dialogue in brainstorming in PBL tutorials at Norwich Medical School. PBL had been promoted, since its introduction to medical schools in the 1960s, as a unique and superior learning method. There was a wealth of material related to PBL theory and evidence supporting one side or other of the fierce debate about whether PBL worked or not. My search for direction on how to be a good PBL tutor exposed limited practical guidance. This led to my undertaking of the Educational Doctorate.

In this chapter I provide an overview of my research and a summary of my findings. I outline my recommendations for PBL tutors and describe how my research adds to the field of literature on PBL.

Research process

As detailed in my literature review, there was a wealth of information relating to the origins and purpose for the introduction of PBL, its theoretical underpinning and an overview of the process. In addition, many publications related to descriptions of practice and studies related to success, but diversity in definition of PBL and huge variability in practice meant that much of the research was not easy to apply to one's own practice, and specific guidance for tutors was lacking. In order to find solutions, I explored the wider literature in the fields of general education, sociology and linguistics. This uncovered different research philosophies that challenged my epistemological beliefs. I developed a new ontological perspective and this helped me to identify apposite and novel research methods.

Conversational analysis enabled me to explore the granular practice of discourse in PBL. It revealed linguistic elements that could be used by tutors to enhance elaborative dialogue, and also demonstrated how tutors could inadvertently and unconsciously inhibit effective interchange. I was also able to identify tacit contextual factors that affected discussion.

Summary of findings

The main research findings were that students and tutors struggled with communication in the brainstorming part of the PBL tutorials, and did not fully

understand the pedagogy – which had some flaws. Students found brainstorming difficult. In order to build and maintain social relationships within the PBL group, the students' default position was social dialogue. Engagement in academic dialogue was of greater educational value but of greater risk. Students tried to avoid exposing their own or others' lack of knowledge. Students found it difficult to chair PBL tutorials and my data suggest that they lacked leadership training and experience. Calls for inclusion of leadership training for all doctors, and the inclusion of leadership training in the undergraduate medical curriculum may enable the encouragement of students to develop these skills (GMC 2012). In addition, the students found the power dynamic difficult to manage. They saw the tutor in a position of power and found taking over the role of chair very difficult. My data suggests that it is necessary for the tutor to be clear about the hand-over of the chairing role, and also be willing to support the student in this role.

Students revealed they struggled to balance the pedagogical ideology of PBL with practice. They were aware that they should identify their own learning needs, but had to balance this with their anxieties about covering the prescriptive undergraduate medical curriculum. The students had a range of methods that they used in order to get the learning outcomes. In addition, students were used to normative classroom dialogue patterns and hierarchical structure, and found transition to a model in which the tutor was not a subject expert to be a challenge.

Tutors also struggled in brainstorming and frequently defaulted to the normative role of the teacher in the classroom as the holder of knowledge and power. Tutors

wanted to help the students learn but were under-confident with the different classroom dialogue pattern of PBL. Tutors had limited understanding and belief in the pedagogy. My data supports previous research that shows that teachers are influenced by their own learning experiences and are likely to model their practice on this. Tutors had limited or no experience as a learner in PBL. In addition, the tutors had received minimal training and did not use recognised facilitation techniques effectively. The new dialogue pattern was challenging for both students and tutors. Tutor struggled with the lack of clarity about who was in charge.

My data suggested that tutors needed to find a balance between relinquishing tight control of dialogue whilst staying closely involved, and paying attention to what was being said. The tutors needed to be able to recognise when and how to intervene to create elaborative dialogue between learners. My research highlights the need for PBL tutors to have more specific training in facilitation techniques, and also better grounding in pedagogical theory in addition to skills and opportunities to reflect on their classroom questioning techniques to create elaborative dialogue.

The facilitator's role is often overlooked and perceived of being of little importance in the student-centred nature of PBL. but my data highlights that the tutor is crucial to the function of the group particularly in brainstorming. Multiple factors prevented students from engaging in elaborative dialogue, and without an effective tutor, the PBL process did not naturally occur. I have indicated that tutors have considerable power to enhance the communication in PBL by use of effective interventions.

Reflection on the research

My research enabled me to identify a number of reasons for the difficulties experienced in PBL brainstorming, and to make a number of recommendations to the Norwich Medical School in order to enhance the learning environment for the students. It enabled me to identify contextual factors that inhibited dialogue in brainstorming, and assisted me to develop specific linguistic guidance for tutors. It also provides a research method that can be replicated for personal use.

The difficulty that the students encountered in chairing the sessions appeared to be due to lack of skill and training, but this was not something I explored in the research. It also seemed that the power dynamic in which the tutor was an authority figure also prevented the students from undertaking an effective chairing role. Further research in this area would be of great interest and a Foucauldian analysis would help illuminate the issues.

The game playing conducted by the students in order to get the learning objectives, whilst appearing to follow the PBL rules, was another area that I did not fully explore. This was it seemed, in part, also related to the power differential between tutor and student. I had originally intended to interview students and tutors and analyse the data to explore these issues. I did conduct some interviews with tutors and students, and began analysis but, when the primary focus of my research changed to understanding the communication within PBL, I found that the interview data contained little of relevance because communication patterns in PBL were largely unconscious. In hindsight, a full analysis of the data might have helped

me understand the contextual factors of the game playing and the power dynamic. Another consideration regarding the interview data was that, I also wondered to what extent both students and tutors were telling me what they thought I wanted to hear: a recognised problem of insider research (Hellawell 2006).

The decision to use audio recording limited my data to verbal interactions that missed the many nonverbal ways that tutors can interact with students through eye contact, gesture and facial expression. This is an important area for further research, and the availability of new technologies that utilise unobtrusive data capture methods can be used by tutors themselves (with students' consent) and researchers, to shed further light on ways that tutors can facilitate students to engage in elaborative dialogue.

My decision to sit in and observe the tutorials in person was in some ways an advantage as I was able to recognise the limitation of the audio recording, but it also had an impact on the group dynamics and function. My position as head of PBL put me in a position of authority which undoubtedly made the students and possibly tutors somewhat anxious. A solution to this would be for tutors to audiotape their own sessions.

The research design may have been made more generalisable by inclusion of other year groups from the medical school or indeed other medical schools. This may have enabled me to identify additional issues and contextual factors that could impact on PBL dialogue. The ability of the research methods to be replicated by

individual tutors and locally by other institutions may be of greater importance than the findings themselves. Further research will hopefully be done in this field.

The analysis of the data proved difficult when the eleven people talked over one another and visual information may have been useful in this regard. Use of a professional transcriber was of great value as it aided me to get a feel for the data set as a whole from which I was able to identify extracts of relevant discourse to analyse in greater depth. Deeper insight may have been obtained by sharing the data with the participants and considering their interpretation. I could have also used more detailed field notes.

Overall, the study was successful in enabling me to uncover at least some of the factors that were affecting the tutorials at Norwich Medical School. This information is useful to the universities at a time when students are consumers and vocal about the quality of teaching in higher education establishments.

Reflection on PBL

PBL was developed in 1960's in Canada and introduced into the United Kingdom in the 1990s to solve problems of the undergraduate curricula. Difficulties of heterogeneity and the issues of research in the real world have impacted on the ability to evaluate its effectiveness. Since its introduction many things have changed which have altered the learning and teaching environment in medicine. One of the most influential changes has been the advance of the internet, which has changed the way we learn and also practice medicine. Medical teachers find it difficult to keep abreast of the rapidly changing facts. Doctors are no longer the

only source of medical knowledge and accumulation of facts is no longer the most important skill. In addition, the doctor is no longer expected to tell patients what to do and, dialogue has become more important. Doctors need skills to be able to search for information, evaluate information, and negotiate knowledge with patients in shared decision making.

The ideas that self-directed learning through PBL would increase the students' retention of facts and their recall in the clinical situation *(Barrows 1983)* remains questionable, but in many ways PBL is a success; it has been widely implemented and continues to be used worldwide possibly related more to the changing learning environment related to access to information through the internet that any unique superior pedagogy.

My data show that students struggle to reconcile the original philosophy of PBL with the prescriptive nature of the undergraduate curriculum in 2018 but that a good learning environment can be created with skilled facilitation. My data shows that whilst the layout of the classrooms and dialogue patterns of PBL may look different to other ways of learning, the principles in PBL are those of good teaching and facilitation and these can be traced as far back as Socrates.

Recommendations for practice

There is no one way that classroom talk should be enacted, and it is influenced by not only cultural norms, but also the subject area itself as well as many other things including context and relationships between students as well as the tutor. My advice can serve as a starting point to reflect on practice. My findings highlight the

importance of recognition of different classroom dialogue models on the part of the tutor and suggest that training in this area could enable the tutors to promote different dialogue patterns. It is recognised that the tutors can use the same words with different effect on different occasions. The recommendations can be used as a guide but tutors should also reflect on their own practice. My advice is for tutors to; ask students for permission to audiotape a tutorial, listen to the student responses, reflect on the group process and the effectiveness of the dialogue, and identify ways to improve their questioning techniques.

Advice for PBL tutors at Norwich Medical School

Tutors need to be self- reflective about their tutoring skills.

One way to do this is to ask your students to allow you to record a short section of your PBL tutorial and analyse the questions you ask. Brainstorming is a time for students to think about their existing knowledge and share this with others in the group. They should read the case and consider what they already know and try to recall knowledge from previous learning experiences. Students can be asked to write down one thing they know and something to ask the other students in the group. Encourage students to answer each other's questions. If no one is able to answer the question the scribe should record this as a learning need.

Students will need encouragement to share their knowledge with the other members of the group. Brainstorming is difficult for students who may worry about revealing ignorance and feel judged by their colleagues and the tutor. In order to get the best learning experience from brainstorming the students need the support of the tutor. Effective dialogue will not happen without effective tutor intervention.

The tutor's role in brainstorming is to

a) Keep the discussion focused

b) Keep the discussion intellectually responsible

c) Stimulate the discussion with probing questions

d) Periodically summarize what has and what has not been dealt with and/or resolved

e) Draw as many students as possible into the discussion (Paul and Elder 1997).

Top tips for PBL tutors

T=Tutor

S=Student

1 Use open questions.

At the start of brainstorming, find out what students already know. This is best done through use of open questions (Russell and Watt 1990). Listening to other students is a good way to learn. This is based on constructivist learning theory which suggests that learning takes place through a series of active steps by which learners build knowledge (Bruner 1961). Closed questions are barriers to elaborative discourse.

Example of student responses to open and closed questions

Open:	T	What do you understand by the term blackout? (Open)
	S	It's when um, there's no, um warning? Well, there are two types; there's the blackout when you don't remember anything or there's a simple faint↑?
Closed:	T	Have you covered that before – congenital heart problems? (Closed)
	S	NO

2 Use short questions.

Short questions make it easier for student to focus on similar aspects of the case. Responses to the question will fit in better with other students' thought processes to enable students to learn more effectively from each other. Learning is more effective when students are actively engaged in an activity rather than the passive recipients of facts (Piaget 2001). Short tutor questions provide greater thinking time for students and lead to longer student responses.

Example of multiple student responses to a short question

Q Why is she a fall risk?

S because

S she's elderly

S she on (drugs)

S co morbidity

S asthma, arthritis

S co morbidity

S and diabetes

S and she's partially sighted

S mmm, yeh

3 Leave a pause after asking a question.

If a pause of greater than 3 seconds is left after asking a question it is more likely that the number of student-to-student interactions will be increased. With longer wait time, students spontaneously initiate a greater number of statements, make fewer inferences and interrupt the previous speaker less frequently. Research has also demonstrated that increased wait time can result in higher cognitive level of achievement. Wait time appears to facilitate higher cognitive level learning by providing teachers and students with additional time to think (Fowler 1975).

Example of a response following a pause

Q What else can em, what else can change their INR? (2.5 second pause)

A Warfarin

A Um, would the other drugs matter? So, she's on white pain killers which is presumably the Paracetamol or NSAIDS so kind of general inflammation?

4 Encourage students to respond to the group rather than the tutor.

In PBL, the tutor is not an expert and does not have all the knowledge. Other group members may have knowledge. If the group members are encouraged to interact with each other, sharing of information can take place. The tutor can regulate the dialogue without having to directly respond. Explain to the students that the usual discourse pattern of the PBL classroom is different to the familiar classroom norm in which the tutor was the dominant speaker (Mehan 1979).

Example of effective discussion between students in which they share knowledge.

S Diabetes shouldn't make you partially sighted so I'm guessing

S Yeh, it can

S Yes, it can do

S Yes, if

S it can do it its poorly controlled

S I know it can

S Yeh

S But I mean the idea is it doesn't - shouldn't

S Yes

S yes

S mmm

S I think that's another kind of pointer to she's on her own it's poorly controlled=

S With diabetes you get the neuropathy so you can't feel your feet

S Yes

S mmm

S Yeh the control

S That makes sense. It's probably the control

5 Demonstrate you are listening to students' contributions.

Use of minimal responses for example 'mmm' 'aha' are useful in keeping the student dialogue focused. Find ways of demonstrating you are listening and engaged without taking over the dialogue.

Example of minimal response by tutor to demonstrate listening

S and she's partially sighted

T mmm, yeh

S Yes so putting somebody on Warfarin like that there's a lot of things to take into consideration=

T mmm

S Why did she fall? Did we find that out? Just because she's partially sighted? And a bit old? Or is it cos she's lost blood through

6 Use extension questions to facilitate students to elaborate.

When student volunteer information, ask them to elaborate and get them to expand on their answers to explain their thinking. Elaboration in which students explain their thinking, appears to be of importance in the learning and understanding of concepts (Webb 2009).

Example of use of extension question

T What other things, ‘cos we’ve talked about ulcers. What other things can cause GI bleeding?

S Trauma

S There always

S Trauma, Infection

S Cancer

S Bowel Cancer

S Surgical sieve

S Like Crohn’s or ulcerative colitis or something

7 Intervene if students talk over each other

If students talk over each other information can be lost. Chairing is a skill that can be developed through experience and practice. Students may not have fully developed their skills in the early years of medical school. The student chair may not feel they have authority over peers. Recognise that social relationships are important for students. They may need your skills to regulate the dialogue in brainstorming.

Example of intervention to clarify student contribution and regulate discussion so a point is not lost

S Well, her MCV’s-

S Well the dark stools only the last 24 hours

S Last 24 hour

S Ok, acute

T What were you going to say about the MCV?

S I was just going to say it's still, it's still in the normal range. It's on the lower side but, if was more chronic you'd start seeing a lower MCV?

8 Don't talk for too long.

There are many ways in which students can access information: lectures, seminars, books and the Internet. The role of the tutor is not to impart knowledge but to get the students to discuss their understanding of medical concepts and learn from each other (Vygotsky 1978).

Example of student response to lengthy tutor contribution

T Yes, so, we, didn't we talk - someone mentioned that in the PBL today, electrolytes you'd check. And I was going to ask- I didn't ask at the time, but the most probably, most important electrolyte for arrhythmia disturbance is potassium. Um funnily enough, sodium's not, doesn't seem so important. Very low high sodium's don't tend to run into the cardiac channel. Um would it help now, because you've gone through most of the module now, to just talk about the scenario? And what you know already? In terms of um you've talked about epilepsy part of it so, do you know how to start to form

a differential now of the syncope? So, someone comes in with syncope in terms of what your differential diagnosis would be and then what questions you'd be asking?

S Like?

9 Don't ask questions with multiple parts

Time is needed after asking a question for cognitive processing to take place. The cognitive processing model formulated by Stahl highlights the importance of actively processing stimuli within the first few seconds of receipt (Stahl 1994). Questions with multiple parts can therefore create a pedagogical problem for students.

Example of student response to a tutor's question with multiple parts.

T This is a point of interest. This story. A couple of weeks ago, I met a man, you know, who had a renal transplant. He had diabetic myopathy and he had a cardiac arrest, at a gym, um, which I think was, just been taken over by Virgin and Virgin had a policy that they needed, they needed, all the staff had to be trained in CPR and had a defib on site- whereas before it didn't. And he had his arrest seven days after the staff where trained. And so, he came in, obviously they brought him back, um so, anyway- if he came in and so you'd got a man who died, had a renal transplant. What would you be suspecting as a cause- he's quite young- he's 40.

S Rejection?

T It about electrolytes

10 Don't use question tags e.g. isn't it?

Recognise that as the tutor you are in a position of power in the PBL tutorial. It is likely that the students will agree with what you say. Question tags provide opportunity for low risk contributions from students, but this is at the expense of higher order thinking.

Being an effective PBL tutor is a skill that takes time to master. An effective tutor can enable students to have an enjoyable useful learning experience in PBL brainstorming.

Example of a student's response to a question with a tag

T So, do you feel you need to know more about what causes blackouts, and, because there are possibly lots of causes of them. Is that, is that fair comment?

S Yes

11 Plan the PBL tutorial in advance with the student chair

Students may not have had much experience at chairing a meeting. In order to learn this skill, students will initially need some support. Offer students this support and help them to plan the tutorial. Chairing is a leadership skill that is a requirement for all doctors (GMC 2012).

12 Support the student chair to chair the PBL tutorial

Recognise that as a tutor, you are in a position of power. Make it clear that you are handing some power to the student chair to enable to student to regulate the dialogue. Make sure the other students are also aware that this student is in charge. The classroom dialogue pattern with which students may be familiar is one in which the tutor takes every other turn (Mehan 1979). Make it clear this is not what is expected in PBL and you want to the student to talk to each other and respond to each other. Some students might find it easier to stand at the front of the class when they are in this role.

To summarise PBL tutors should

1) Use open questions
2) Use short questions
3) Leave a pause after asking a question
4) Encourage students to respond to the group rather than the tutor
5) Demonstrate you are listening to students' contributions
6) Use extension questions to facilitate students to elaborate
7) Intervene if students talk over each other so information is not lost
8) Don't talk for too long
9) Don't ask questions with multiple parts
10) Don't use question tags e.g. isn't it?
11) Plan the tutorial in advance with the student chair
12) Support the student chair to facilitate the session

Contributions to the field of medical education and medical education research

My research adds to the field of medical education and medical education research in four main areas.

Firstly, I have demonstrated that elements of conversation analysis are a useful research method by which to analyse PBL practice. The conversation analysis method could be replicated by others wishing to explore ways in which PBL brainstorming can be made more effective in their own institutions. It provides a practical method that can be used by tutors themselves to analyse their individual performance as a tutor to improve practice. I have provided tutors with a method with which to reflect on practice.

Secondly, my research using elements of conversation analysis allowed me to identify linguistics elements that can be used to promote effective dialogue between learners. This has enabled me to produce guidance for tutors on verbal strategies they can use to facilitate effective dialogue between learners in PBL. I have provided specific guidance on the types of question to use in order to encourage elaborative dialogue between learners in brainstorming in PBL.

Thirdly, my data revealed contextual challenges that affected the pedagogical process and students and the tutors' ability to engage effectively in PBL. My data demonstrate how elements of conversation analysis can be used to identify the contextual factors that affect communication that may not be recognised by individual tutors or institutions.

Fourthly, my research sheds light and offers further explanations for why outcome-based research in PBL has shown variable conclusions: the variable nature of the quality of communication that takes place between learners in PBL can be added to

the list of other variables that make PBL a heterogeneous learning environment. This makes comparative research unhelpful in development and improvement in practice in addition, comparisons do not provide guidance for improvement in practice. My research highlights the need for qualitative reflective work based on the reality of what is taking place in the learning environment and not an idealised version of PBL.

PBL can be a useful and enjoyable learning experience for students. The quality of the learning experience is dependent on effective dialogue between learners. The PBL tutor plays a vital role in enabling the students to communicate effectively. It is the tutor's responsibility to facilitate PBL tutorials effectively to maximise the learning opportunities available for students.

Contribution to PBL at Norwich Medical School

As a result of my research project, I continue to be a PBL tutor. My personal feedback has improved. I have introduced training for students and tutors in questioning skills and how to effectively chair PBL sessions. I have made changes to the tutor reports to include feedback to students on their chairing skills. I have recruited more students to be tutors in year 2. This was popular and successful and I subsequently extended this to years 1- 3. Feedback from students about their PBL tutors remains high and has improved hopefully, in part, due to these changes (Appendix 6).

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Appendices

Appendix 1 Extract from Tutor Discussion Forum minutes

YEAR 1

TUTOR DISCUSSION FORUM

Minutes of discussion year 1 2012

BRAINSTORMING

Thought to be much easier now that the students are aware they will get the LOS at the end of the session. One tutor reported she could now have a really good discussion around a few large themes rather than focus on each LO

We acknowledged that brainstorming is hard and tiring for the students

They fear upsetting people/ looking silly etc.

Try to ensure that you emphasis that the group should keep some things within the group! (Put this in ground rules)

We need to get the students to the LEARNING EDGE this is a little uncomfortable as it is the point of uncertainty. It is hard to identify when students are on the learning edge- you have to listen very carefully!

We discussed

DIFFICULTY IN HELPING STUDENTS CHAIR

We decided to try and focus more on this in the first PBL introductory session (when we go through the 12 tips for students)

We felt focus on 4 objective for the role of the chair

In the reporting Phase

1) Have a structure for the session
2) Give individuals equal time for their feedback presentations
3) Ask them the queue up the next presenter / presentation
4) Encourage equal participation

In the Brain storming phase

1) Try to encourage equal participation
2) Try to ask each student for one thing they know and one they would like to know (Scribe could write these on the board)

Year 2

Minutes of discussion year 2 2012

We discussed trying to get students to elaborate more

One tutor had explained to the group that she wanted them to do this and explained the reasons for doing this but the group were still not really elaborating enough
So she demonstrated exactly how to do it using Kahoot and a PowerPoint presentation
She modelled good practice.

CHAIRING
This was identified as sometimes not optimal

Year 2 tutors suggested the role of the student chair was

1) Arrive early and set up the room
2) Keep time
3) Give structure to the session
4) Encourage contribution

We suggested that it was good to give feedback about chairing and mention it on the tutor report and explain it is a transferable skill.

BRAINSTORMING

Difficulty in getting students to do this effectively

1) Ask students to make a list of what they do not know
2) A list of what they do know

This seemed to work to some extent

Or

1) Ask each students to contribute something they do NOT know and throw this over to the group to see if anyone does know the answer
2) Ask each student to say one thing they DO know and to share this with the group.

We acknowledged that getting students to the learning edge is difficult.

POSSIBLY START WITH THE TUTOR SAYING ONE THING THEY DON'T KNOW

Appendix 2 Participant Consent Form

Participant consent form

Title of Project: An Exploration of Problem Based Learning at Norwich Medical School.

Name of Researcher: Dr Pauline Bryant

Please tick the following

1. I confirm that I have read and understand the information sheet entitled Participant Information Sheet. Please initial …

2. I have had the opportunity to consider the information, ask questions and have had these answered satisfactorily.

   Please initial...

3. I understand that my participation is voluntary and that I am free to withdraw at any time without giving any reason. Please initial…

4. I agree to take part in observation of my PBL tutorial. Please initial…

5. I agree to the tape-recording of the PBL tutorial. Please initial…

6. I agree to take part in an interview. Please initial...

7. I agree to the tape recording of the interview. Please initial...

Data will be stored to comply with Data Protection Act. Access to the data will limited to Pauline Bryant and Nigel Norris. We will use 'non attributable quotes' which means that it will not be possible to identify what an individual has said when we have transcribed the data.

Name of student/tutor ……

Signature

Name of person taking consent ……Pauline Bryant.....

Signature

Date

Appendix 3 Participant Information Sheets

A1. Medical Students

Participant information sheet

Exploration of Problem Based Learning in the MBBS Curriculum at Norwich Medical School.

Information for Norwich Medical School Students

I would like to invite you to take part in an educational research project being undertaken at the University of East Anglia. Before you decide whether or not to participate it is important that you understand why the project is being done and what it would involve for you. Please take the time to read the following information and discuss it with others if you wish.

Who is conducting this research?

The project is being undertaken by Dr Pauline Bryant as part of an Educational Doctorate at the University of East Anglia. Dr Pauline Bryant is a General Practitioner and a Deputy Course Director for Year 2 of the MBBS curriculum. The project will be supervised by Professor Nigel Norris who is Professor of Education at the School of Education and Life-Long learning at UEA.

The study has received ethical approval from

EDU Ethics Committee

School of Education and Lifelong Learning

University of East Anglia Norwich Research Park

Norwich NR4 7TJ, UK

The Information is divided into two parts

Part 1: The background to the study including the purpose of the study and how the results will be used.

Part 2: The research process and details of what you will be asked to do, including the time commitment if you decide to take part.

Having read the information if you would like to take part, please sign the consent form. If you would like further information please contact me at pauline.bryant@uea.ac.uk.

Part 1

Background and purpose of the study

Case scenarios are central to Problem Based Learning (PBL). Despite claims that use of case scenarios is beneficial to learning, students and tutors at Norwich Medical School (NMS) often report dissatisfaction with their use in the PBL tutorial. The purpose of this project is to explore this issue in order to try and improve the learning value that case scenarios can provide.

The focus of the research will be to explore the many possible functions that scenarios can play in teaching and learning, describe the functions that case scenarios currently play in PBL at Norwich Medical School, identify factors contributing to dissatisfaction with the use of case scenarios and provide recommendations to improve the learning value of case scenarios.

Why have you been asked to take part?

You have been invited to take part because you are a medical student at Norwich Medical School and your opinion and experience is important in the development of the curriculum.

What are the benefits of taking part?

There may be no direct benefit to you from taking part in the study. You may learn something about what motivates your learning by reflecting on certain aspects of the course.

Are there any risks of taking part?

I do not anticipate any risks in taking part. If you feel unhappy or uncomfortable at any time you may leave the study. Your decision to participate or otherwise will not affect your learning experience and/or your assessment, and lecturers other than Dr Pauline Bryant and your PBL tutor will not be aware of your participation.

Use of results

The results will be used to inform curriculum planning at Norwich Medical School.

How will the results be disseminated?

The study will be submitted to the Exam Board at The School of Education and Life Long Learning at UEA. Parts of the project may be submitted for publication in Educational Journals and for presentation at an education meeting. Individuals will not be identified in any reports or publications. The write up and results of the study will be made available to participants on request. We will not provide participants with the original recordings or the transcripts.

Part 2

The research process

A qualitative research design will be used and there will be 4 parts

1) Observation of scenarios in practice

2) Interviews with PBL tutors

3) Interviews with students

4) Analysis of written student feedback

Student and Tutor Recruitment to observed sessions

Participation will be voluntary. Tutors and PBL groups will be recruited as a unit. I will provide written information about the project and individual consent sheets for tutors and students. I will explain the project to PBL groups (unless your tutor prefers to introduce the project to your group).

Students and the tutor from groups in which not all students wish to take part will not be observed.

Individuals will be able to make an independent decision as to whether they want to take part. I will collect completed consent forms a week after distribution and provide new consent forms for anyone who has forgotten or lost it.

Individual's decisions will not need to be made known to other students or the tutor. Groups in which all students and the tutor consent to take part will be observed. Students and tutors who have consented to it will be interviewed.

I would aim to recruit between 3 and 6 groups. If only 3 groups are recruited it would be necessary to observe the use of 2 scenarios by each group i.e. groups would be observed twice. If 6 groups are recruited I would observe each group only once.

What will happen in each part?

OBSERVATION OF SCENARIOS IN PRACTICE

What will happen in the observation of scenarios in practice?

Dr Pauline Bryant will observe use of scenarios by the group and tutor in one of your usual PBL tutorials; Dr Bryant will take field notes and audio-record the session.

What will you be asked to do and what is the time commitment for the observed PBL tutorial?

You will not be expected to do anything other than take part in your PBL tutorial in the usual way. If you decide to take part there will be no extra time needed as the observation will take place during the usual PBL tutorial session time. Elements from this may be used to inform questions for the interview

INTERVIEW

What will happen in the interview?

You will be asked some questions about your experiences and opinions about aspects of case scenario use in PBL. Written notes will be taken during the interview which will be audio recorded and later transcribed.

What will you be asked to do in the interview and what is the time commitment?

If you decide to take part, an interview will be arranged at a time that is suitable for you. The interview will be less than one hour long. The interview will take place at UEA.

ANALYSIS OF STUDENT FEEDBACK

What will happen in the analysis of student feedback?

Dr Bryant will read the annual student feedback and identify information relevant to case scenarios.

What will you be asked to do?

You will not be expected to do anything other than complete the annual feedback in the usual way. Your feedback will be used to triangulate information. You will be asked to consent for the data to be used in the project at the time you complete the annual feedback. Your decision to give or withhold consent will not affect your learning experience. Lecturers other than Dr Pauline Bryant and Susan Miles (annual feedback coordinator) will not be aware of your participation. If for any reason you later decide that you did not want something you wrote in the annual feedback to be used in the project, your feedback would not be included in the project. We will use 'non attributable quotes' which means that it will not be possible to identify what an individual has said.

GENERAL INFORMATION

Will the information be kept confidential?

Information will be kept confidential and ethical guidelines will be adhered to. Raw data will be destroyed at the end of the study.

Data and Transcripts

Pauline Bryant will transcribe and analyse the data. The data will be stored in compliance with the data protection act. Access to the original data will limited to Dr Pauline Bryant and Professor Nigel Norris. We will use 'non attributable quotes' which means that it will not be possible to identify what an individual has said once the data has been transcribed.

If you are happy to take part what should you do?

If you are able to take part, please sign the consent form.

What happens if I have a concern about the study?

If you have a concern about any aspect of this study you should contact Dr Pauline Bryant. If you remain unhappy or wish to complain formally, you can do this by contacting Nalini Boodhoo at N.Boodhoo@uea.ac.uk

Thank you for taking the time to read this information

Dr Pauline Bryant

A2. Tutors

Participant information sheet

Exploration of Problem Based Learning in the MBBS Curriculum at Norwich Medical School.

Information for Norwich Medical School PBL Tutors

I would like to invite you to take part in an educational research project being undertaken at the University of East Anglia. Before you decide whether or not to participate it is important that you understand why the project is being done and what it would involve for you. Please take the time to read the following information and discuss it with others if you wish.

Who is conducting this research?

The project is being undertaken by Dr Pauline Bryant as part of an Educational Doctorate at the University of East Anglia. Dr Pauline Bryant is a General Practitioner and a Deputy Course Director for Year 2 of the MBBS curriculum. The project will be supervised by Professor Nigel Norris who is Professor of Education at the School of Education and Life-Long learning at UEA.

The study has received ethical approval from the

EDU Ethics Committee

School of Education and Lifelong Learning

University of East Anglia Norwich Research Park

Norwich NR4 7TJ, UK

The Information is divided into two parts

Part 1: The background to the study including the purpose of the study and how the results will be used.

Part 2: The research process and details of what you will be asked to do, including the time commitment if you decide to take part.

Having read the information if you would like to take part, please complete the consent form. If you would like further information please contact me at pauline.bryant@uea.ac.uk.

Part 1

Background and purpose of the study

Case scenarios are central to Problem Based Learning (PBL). Despite claims that use of case scenarios is beneficial to learning, students and tutors at Norwich Medical School (NMS) often report dissatisfaction with their use in the PBL tutorial. The purpose of this project is

to explore this issue in order to try and improve the learning value that case scenarios can provide at NMS.

The focus of the research will be to consider the many possible functions that scenarios can play in teaching and learning, describe the functions that case scenarios currently play in PBL at Norwich Medical School, identify factors contributing to dissatisfaction with the use of case scenarios and provide recommendations to improve the learning value of case scenarios.

Why have you been asked to take part?

You have been invited to take part because you are a PBL tutor at Norwich Medical School and your opinions and experiences are important in the development of the curriculum.

What are the benefits of taking part?

There may be no direct benefit to you from taking part in the study but you may learn something about what motivates students by reflecting on certain aspects of the course.

Are there any risks of taking part?

I do not anticipate any risks in taking part. If you feel unhappy or uncomfortable at any time you may leave the study.

Use of results

The results will be used to inform curriculum planning at Norwich Medical School.

How will the results be disseminated?

The study will be submitted to the Exam Board at The School of Education and Life Long Learning at UEA. Parts of the project may be submitted for publication in Educational Journals and for presentation at an education meeting. Individuals will not be identified in any reports or publications. The write up and results of the study will be made available to participants on request. We will not provide participants with the original recordings or the transcripts.

Part 2

The research process

A qualitative research design will be used and there will be 4 parts

1) Observation of scenarios in practice

2) Interviews with PBL tutors

3) Interviews with students.

4) Analysis of written student feedback

Student and Tutor Recruitment to observed sessions

Participation will be voluntary. Tutors and PBL groups will be recruited as a unit. I will provide written information about the project and individual consent sheets for tutors and students. I will explain the project to PBL groups (unless you prefer to introduce the project to your group you self).

Students and the tutor from groups in which not all students wish to take part will not be observed.

Individuals will be able to make an independent decision as to whether they want to take part. I will collect completed consent forms a week after distribution and provide new consent forms for anyone who has forgotten or lost it.

Individual's decisions will not need to be made known to other students or the tutor. Groups in which all students and the tutor consent to take part will be observed. Students and tutors who have consented to it will be interviewed.

I would aim to recruit between 3 and 6 groups. If only 3 groups are recruited it would be necessary to observe the use of 2 scenarios by each group i.e. groups would be observed twice. If 6 groups are recruited I would observe each group only once.

What you will be asked to do

You will be asked to participate in part 1) observation of scenarios in practice and part 2) an interview.

OBSERVATION OF SCENARIOS IN PRACTICE

What will happen in the observation?

Dr Pauline Bryant will observe the use of scenarios by the group and tutor in your usual PBL tutorial; Dr Bryant will take field notes and audio-record the session.

What will you be asked to do in the observed PBL session and what is the time commitment?

You will be asked to take part in your PBL tutorial in the usual way. If you decide to take part there will be no extra time needed for the observation as it will take place during usual PBL tutorial session times.

INTERVIEW

What will happen in the interview?

You will be asked to answer some questions about your experiences and opinions about scenarios used in PBL. Written notes will be taken during the interview which will be audio recorded and later transcribed.

What will you be asked to do at the interview and what is the time commitment?

If you decide to take part, the interview will be arranged at a time that is suitable for you. The interview will be less than one hour long. The interview will take place at UEA.

GENERAL INFO

Will the information be kept confidential?

Contemporaneous notes will be available for view at the time of writing. Thereafter, all information will be kept confidential and ethical guidelines will be adhered to. Raw data will be destroyed at the end of the study.

Data and Transcripts

Pauline Bryant will transcribe and analyse the data. The data will be stored in compliance with the data protection act. Access to the original data will limited to Dr Pauline Bryant and Professor Nigel Norris. We will use 'non attributable quotes' which means that it will not be possible to identify what an individual has said once the data has been transcribed.

If you are happy to take part what should you do?

If you are able to take part, please complete the consent form.

What happens if I have a concern about the study?

If you have a concern about any aspect of this study you should contact Dr Pauline Bryant. If you remain unhappy or wish to complain formally, you can do this by contacting Nalini Boodhoo at N.Boodhoo@uea.ac.uk

Thank you for taking the time to read this information

Dr Pauline Bryant

Appendix 4 PBL Tutor Guide 2011-12

PBL Tutor Guide 2011-12

PBL case scenarios

Week 1 – Chest Pain – Acute Coronary Syndrome

Ajit Baid is a 45 year old Indian accountant who has smoked 5 cigarettes per day for 20 years. He takes no regular exercise and is overweight. He has three brothers and two have undergone coronary bypass surgery.

Two months ago Mr. Baid awoke with severe abdominal and lower chest pain radiating into his left arm which he described as a heavy ache. He thought the pain was severe indigestion but it frightened his wife so much that she insisted that they went to A and E. When he reached hospital the pain had resolved and an ECG there was normal. He was discharged home with a diagnosis of indigestion, with a letter for his GP to investigate his glycosuria found on routine testing.

The next morning the same pain recurred at rest after Mr. Baid had eaten his breakfast and further increased as he tried to walk it off. He returned to hospital where the ECG was now abnormal and a blood test for troponin was carried out. He was admitted to the coronary care unit, where despite medical treatment including controlling his diabetes, he had further chest pain. Mr. Baid underwent coronary angiography which showed he needed surgical revascularization. After surgery, the patient recovered well and both he and his wife took great interest in his cardiac rehabilitation course.

Suggested Topics for Discussion

- What is the place of the heart in the circulatory system?

- What is the Cardiac Cycle? - This is the repeated action of the heart with the periodic contraction of the different chambers of the heart under electronic control. The students need to look in detail at how this happens as an introduction to the rest of this module.

- What is the ECG and why do we use it?

- What are the features of the coronary circulation and how is it regulated? This is the blood circulation specific to the heart itself.

- How important is coronary artery disease as a killer in the UK and worldwide?

- What is the spectrum of coronary artery disease (from asymptomatic to death)?

- What are the features of the clinical syndromes that coronary artery disease can produce – nothing, stable angina, acute coronary syndrome, myocardial infarction, sudden death?

- What is the dynamic nature of the atheromatous plaque and how does this result in the various ischaemic syndromes?

- What risk factors are relevant in producing the disease?

- What are the main methods of diagnosis and treatment and their place in the different syndromes? Why is there a need for rapid diagnosis and reperfusion in the context of myocardial infarction?

- How does coronary artery disease impact on daily life, work and recreation; what is the role of cardiac rehabilitation?

Week 2 – Shortness of breath – Heart Failure

Joe Hendry is a 58 year old publican. Two years ago he stopped smoking (1 pack per day for 30 years) when he realized he was getting short of breath after walking 50 metres. His father died from a myocardial infarction 3 years ago.

More recently Joe has been unable to sleep, needing three pillows to stop him lying flat and becoming short of breath. On one occasion he woke at 2am and had to sit on the side of his bed to catch his breath. He also mentions an ache in his left leg when he walks and an annoying swelling of both ankles at the end of the day. He was aware on one occasion of his heart racing in a very erratic fashion*. Joe's GP diagnosed hypertension a year ago, but he has avoided taking tablets which he didn't feel were necessary.

Joe visited his GP who, on examination, found the typical signs of heart failure. His GP arranged 3 investigations and referred him to hospital for further management. The cardiologist tells Joe he has heart failure and starts drug therapy. Joe asked whether it was serious, how long he had to live and whether he could return to work in the future.

*Note that you will study Arrhythmias in more detail later in this unit.

Suggested Topics for Discussion

- What are the main physiological mechanisms that govern cardiac function and output?
- What are the main causes of heart failure?

- How might patients with heart failure present clinically?
- What is the differential diagnosis of a patient presenting with breathlessness?
- Is there a good definition of heart failure?
- What is the long-term outlook for a patient with heart failure?
- What are the drugs commonly used in treating heart failure, and how do they work?
- What are the respective roles of the domiciliary care/heart failure nurse/ GP?

Week 3 – Abdominal and Leg Pain – Aortic Aneurysm and Peripheral Vascular Disease

A previously fit and well 66 year old gentleman presented to the Accident and Emergency department with severe abdominal pain radiating through to his back. He was a lifelong smoker but had no past medical or family history of note. On examination, he was noted to be sweaty and clammy and his blood pressure was 76/50mmHg. A presumed diagnosis of a ruptured abdominal aortic aneurysm was made and he was taken to theatre immediately. His abdomen was opened and the diagnosis of a ruptured abdominal aortic aneurysm was confirmed. This was repaired and he was transferred to the Critical Care Unit postoperatively. He made a good recovery thereafter apart from a superficial wound infection and was discharged after 8 days. He was commenced on full secondary prevention therapy. When he was reviewed in outpatients six weeks later, his wound was well-healed and his feet were warm.

Six months later, the patient reported pain in his right calf on walking 50 yards. This had been present before his aneurysm repair, but he had not consulted anyone about it. He was reviewed in vascular clinic and his ABPI was found to be 0.6. He was initially managed conservatively but his calf pain gradually worsened and he began to wake up at night with pain in his foot. He was seen again in clinic and now had no palpable pulses and a one-stop duplex scan showed monophasic flow throughout and a right common femoral artery occlusion. The patient was then admitted electively for an iliac angioplasty and stent and common femoral endarterectomy and patch. He made a good recovery from this and was discharged from clinic after three months. Regrettably, he is still smoking despite the surgeon discussing the extreme consequences of continuing to do so.

After discharge he was talking to a friend who had varicose veins and ulcers on his legs who was then worried he may have the same thing.

Suggested Topics for Discussion

- What is the anatomy of the arterial system, in particular the great vessels?
- What is the aetiology, physiology and management of shock?
- What is the pathology of atherosclerosis?
- How do aneurysms form? What is the presentation and natural history of aortic aneurysms?

- What is the role of diagnostic imaging and surveillance for aortic aneurysms? Is population screening of any use?
- How should aneurysms be managed surgically?
- How does chronic leg ischaemia present and what is the natural history?
- What is the role of blood transfusion and use of blood products in the surgical setting? (Overlaps with Unit 3 teaching).

PVD Suggested Topics for Discussion

- What is the anatomy and functional organisation of the blood supply to the limbs?
- What are the pathologies behind the various causes of leg ulceration (venous, arterial, mixed, lymphatic and vasculitis)?
- What are the causes, complications, and treatments for varicose veins and valve incompetence (lower limbs)?
- What is ischemia and what are its presenting features in the lower limb? How can we distinguish between acute and chronic peripheral ischaemia and their respective causes (including embolic phenomena?)
- What are the risk factors for peripheral vascular disease (the concept of the arteriopath)?
- What is the management of peripheral vascular disease (including diagnostic imaging and treatment: conservative, endovascular and surgical)? What are the complications of endovascular and surgical procedures?

- What are the indications, surgical techniques and complications and after care associated with major limb loss?

- What are the features of limb fitting and rehabilitation, including costs? Is there a role for psychological support and counselling?

Week 4 – Weakness and Collapse - Stroke

Case 1

Mr JB is a 75 year old retired company director who moved to the region recently. *He doesn't smoke, drinks about 2 units of alcohol (red wine) a day. At the routine check-up at his GP surgery, his BMI was 32.5 kg/m2, his blood pressure was noted to be 170/100mmHg. Blood tests from clinic were unremarkable except for high total cholesterol of 6.7 (HDL cholesterol of 0.5). His GP said to him that his BP need to be checked again discuss about the options of reducing his cholesterol level, advised on diet and exercise. Three days later while he was having Sunday Lunch at the local pub with his wife, he suddenly lost the use of his right hand. His face was also drooping on the right side and he was unable to speak and stand. Having seen the FAST campaign on television, his wife suspected that he was having a stroke and called 999. The ambulance paramedics confirmed the stroke and the thrombolysis on-call team at NNUH was pre-alerted. His BP on arrival to A&E Resus was 200/110 mmHg. He was assessed immediately by the stroke team and thrombolysis with rTPA was given within 60 minutes of onset as CT scan did not show any obvious abnormality except hyperdense middle cerebral artery sign (dense MCA sign) on left side. He recovered rapidly over next 24 hours: his speech improved dramatically and his limbs weakness was almost negligible the following day with minimal facial weakness. He

underwent urgent in-patient investigations including ECG (Sinus Rhythm with features of Left Ventricular Hypertrophy), CXR (normal), echocardiogram (good biventricular function, hypertrophic LV), carotid duplex and 24 hour ECG tape (sinus rhythm with occasional ventricular ectopics). Carotid duplex showed 60% stenosis of right internal carotid artery and 80% stenosis of left internal carotid artery. He was referred to the vascular surgeon on-call and he underwent left carotid endarterectomy on the next available emergency list. He made a good postoperative recovery. He was discharged on Clopidogrel 75 mg OD, Amlodipine 5 mg OD, Lisinopril 10 mg OD, Simvastatin 40 mg OD. A community stroke follow up was arranged at 6 month.

*You spend a week looking at the risk factors in much more detail after secondary care but you do need to start considering them now for use in your clerking of patients.

Case 2

Mrs EP is 90 year old who is normally fit and well. She has not seen her doctor for many years and the only medication she takes is paracetamol for occasional general aches and pain. She lives alone in a bungalow. She doesn't drive. She enjoys gardening and walks regularly to keep fit. She has never smoked, drinks alcohol daily (a can of Guinness a day). She was found collapsed in her garden by her neighbour and assessment by ambulance crew showed she had reduced level of conscious (Glasgow Coma Scale of 13). She was brought to hospital immediately. On arrival to hospital her blood pressure was 220/130 mmHg, urgent CT brain scan showed very large right parietal haemorrhage with some intraventricular extension, with minimal mid-line shift. Clinically she had dense hemiparesis

of left side of body, left facial palsy and left sided visual and sensory extinction (inattention). The scans were sent to nearest neurosurgical centre but it was decided that further intervention was futile. She was managed conservatively with intravenous fluids. On day 4 her GCS was 15 and able to sit out on a chair with hoist transfer. She had dysarthria and also had swallowing difficulty and was on thickened fluid and pureed diet for nearly two weeks. Her post stroke recovery was complicated by aspiration pneumonia at day 6 but she recovered after a course of antibiotics (she was put back on nil by mouth for 3 days and reassessed by speech and language therapist prior re-commencing oral intake). Her swallowing gradually improved but lost about 5 kg in weight over 3 weeks; her inattention also improved but motor power returned only to grade 3/5 by end of week 3. She appeared depressed on mood screening and she was commenced on an antidepressant. She was then transferred to rehabilitation unit from which she was discharged to a nursing home one month later. Her discharge medications included paracetamol 1 gram QDS prn, amlodipine 10 mg OD, and Lisinopril 10 mg OD.

The students should have a clear understanding of differences between

Dysphasia- speech difficulty either expressive, receptive or mixed (usually controlled by dominant side of the brain)

Dysphagia- swallowing difficulty (can happen with any type of stroke which can affect swallowing)

Dysarthria- slurred speech (usually due to non-dominant hemispheric or posterior circulation stroke)

Suggested topics for discussion

- What is the definition of stroke and TIA?
- What are the risk factors for stroke and how are they managed (primary and secondary prevention)?
- What is the cerebral autoregulation (CA)? What factors influence the CA?
- What are the pathophysiology of different types of stroke?
- What is the pathology of completed stroke and what important differential diagnoses should be considered (including sub-dural, sub-arachnoid and extra-dural haemorrhage, primary brain tumour/secondary brain metastasis)?
- How do patients with stroke/TIA commonly present (symptoms, signs)?
- What are the complications of stroke (including dysphagia/ aspiration pneumonia, DVT / PE, spasticity, shoulder subluxation, depression, pressure sores)? How can good clinical care be used to prevent these complications?
- What are the indications and contraindications for thrombolysis treatment in acute ischaemic stroke?
- What are the indications for carotid endarterectomy for carotid stenosis?
- What are the roles of multidisciplinary team members on a stroke unit (acute and or rehab)? What are the social sequelae of stroke?

- Which treatments can we use to reduce the risk of recurrence in patients with stroke/ TIA (secondary prevention) including BP management (BHS guidelines)?

- What are the indications of surgical intervention in stroke?

Week 9 – Life is risky

Case 1

Mrs Joan MacDonald is a 55 year old West Indian Store Manager still enjoying her work but stressed with a recent reorganisation. She booked in for a Heath Check because she had tried doing her BP at the Chemists where they had found a high reading 168/103. She had just been swimming at the local pool and knew they were running late for a lunch appointment so she had not been at all surprised at the reading.

Her first appointment was with one of the Practice Nurses who ran Diabetes and Hypertension risk assessments and repeated her blood pressure, which was 175/98. Her BMI was 31 and she has a strong family history of type 2 diabetes. As a result she arranged further blood tests and a follow up Blood Pressure. The nurse asked why she had not had regular follow up since her Gestational Hypertension 20 years ago.

A week later she was seen by her GP with the results who asked her questions about her family and health and examined her. His BP was 158/99. His cholesterol was 6.5 mmol/l with normal HDL.

Her GP ordered an ECG and started Mr McDonald on Amlodipine. And on simvastatin 40 mg OD

2 weeks later Mrs McDonald appeared very unhappy with her newly swollen ankles. Her GP explained the need for treatment and changed to Indapamide 2.5mg OD

Unfortunately at her months follow up his BP was only reduced to 154/89 for 2 readings so her GP suggested adding in Ramipril 2.5mg on with a blood test 1 week later.

She was seen at 1 month BP 146/84

At 3 months BP read 198/98 with the nurse who referred her back to the GP that day. The GP asked what medication she was actually taking. Mrs MacDonald explained that her mother in law had fractured her hip last week having collapsed after taking a new BP tablet. She really did not want to take any tablets. Her GP talked him through the alternative tablet treatments as well as the alternatives to tablets. Mrs McDonald asked about gastric banding that she had heard about on the news.

Case 2

Maximilian Smith is a retired lawyer, 81 years old. 3 months ago he had a small TIA. Up until now he had well controlled long standing hypertension on ACE Inhibitors. He was seen by the Practice Nurse for a routine BP check and was found to have an irregular pulse – HR110 at the Apex. An ECG confirms AF, discusses warfarin/aspirin and beta blockade. He decided on aspirin despite his CHADS2 score and beta blockade which are commenced before referral to the cardiologist for further advice.

- Where does blood pressure arise from and how is it regulated in a healthy individual?

- What are the main causes of high blood pressure?
- How can we treat high blood pressure and what difference does it make?
- What is a normal cholesterol and why is it raised in some people?
- How can we treat hyperlipidaemia in a population?
- How can we treat hyperlipidaemia in the individual and what difference can it make?
- What is obesity and how is it best managed in a population and individual?
- Why is diabetes an important risk factor, particularly with regards to insulin resistance and also obesity?
- What are the genetic and cultural variations in the epidemiology of cardiovascular disease?
- Describe the use of Risk Calculators such as QRISK for cardiovascular disease or CHADS2 in stroke in an individual
- Describe the appropriate management of Atrial Fibrillation as a risk factor for stroke

Week 10 – Short of breath – Valve Disease

Jack Spratt is a 55 yr. old male. He is a painter and decorator. Previously well but lifelong cigarette smoker. He has no family history of heart disease. For the last 6 months he has found that it is increasingly difficult to work because he is so tired and cannot carry his

ladders because of Shortness of breath. As well as his SoBoE he also describes orthopnoea and some ankle swelling.

On examination Mr Spratt has a Systolic murmur 3/6 intensity at cardiac apex and it is also heard at the base of the heart. His carotid pulse is hard to feel. JVP raised 6cm

His GP orders a BNP, FBC U and E CXR and ECHO on the basis of the results he refers urgently to the Cardiologist

Suggested Topics for Discussion

- What are the important anatomical structures of the heart and what are pressure and flow changes during the cardiac cycle?
- How does the spectrum of valve disease vary between the developed world (where rheumatic fever is common), and developed nations?
- What are the common causes of murmurs and the lesions that cause systolic and diastolic murmurs?
- How should we manage elderly patients with aortic stenosis?
- What are the symptoms due to valve disease and the different clinical presentations of lesions affecting different valves?
- What are the available treatment options for various types of valvular heart disease?

- What is the role of echocardiography in diagnosing valvular heart disease?
- What are the basic principles of cardiac pacing?

Week 11 – Odd heartbeat and Collapse – Arrhythmias and Syncope/Arrest

Case 1

Mary Phillips is 68 years old and over the last few months has had several blackouts. She feels dizzy and unwell; she thinks her heart may race a bit beforehand but that is the last thing she remembers. When Mrs. Phillips' GP asks her to tap her pulse out on the desk the rate seems to be fast and erratic. Although it occurs more when standing and possibly when looking up, it also occurs when she is sitting. When she comes round she feels tired but next day is fine. After one episode, she has bruised herself all down one side. Her husband says that she goes very pale but does not jerk her limbs, nor is she incontinent. Mary is taking 100mg Atenolol for her blood pressure. She weighs 50kg. Her husband asks her GP if she should drive.

Mrs. Phillips is referred to the hospital and after a number of investigations has a special kind of pacemaker fitted as well as being prescribed some other pills to thin her blood. Her cardiologist says she has an abnormal heart rate. She feels very frightened about the whole business. When she gets home she visits the GP to ask about flying

Case 2

June Salter is a 65 year old retired accountant married to John. June was out shopping with her husband in the local superstore where she collapsed unconscious. The store manager had recently trained staff in resuscitation and installed defibrillators. A member of staff was able to successfully resuscitate and defibrillate June. In the ambulance, June had an episode of ventricular fibrillation treated by the paramedics. In hospital, investigations showed she had suffered a large anterior myocardial infarction and she was given thrombolysis. Over the next hour in the coronary care unit, June was unwell with her heart rhythm fluctuating between sinus rhythm, ventricular tachycardia and a brief episode of asystole. Her plasma potassium was raised (7.0mmol/l). June became unconscious, her blood pressure fell and the doctors discussed her resuscitation status with John.

Suggested Topics for Discussion

- What is the differential diagnosis of blackouts?
- What aspects of the history-taking can help us in diagnosing the cause of the blackout?
- How is the normal heart rate regulated physiologically? What are the definitions and causes of bradycardia (slow) and tachycardia (fast)?
- How do we manage tachycardia and bradycardia (including medical therapy, pacing, ablation therapy and defibrillators)?

- What tests can help us in the investigation of blackouts?

- Do cardiac rhythm disturbances have an effect on everyday events and on eligibility to drive?

- What are the main causes of sudden unexpected death?

- Are there major differences in the outcome of resuscitation in hospital as compared to in the community?

- What investigations should we carry out in patients who survive cardiac arrest in or out of hospital, and why?

- What are the principles of basic and advanced life support /resuscitation?

- How do we make decisions on when not to resuscitate and when this may be appropriate? What about the involvement of the patient and relatives?

- What is the impact on the family of sudden unexpected death?

- When do we need to inform the coroner and why should a post-mortem be considered?

Appendix 5 Ethics Approval

From: Jacqueline Watson (EDU)

Sent: Monday, August 13, 2012 4:59 PM

To: Pauline Bryant (MED)

Cc: Nigel Norris (EDU); Dawn Corby (SSF)

Subject: RE: Ethics application for EdD

Dear Pauline,

Thank you very much indeed for your carefully revised application. You have addressed the issues we raised and I am writing to confirm that you now have approval from the EDU research ethics committee to begin your research.

I do apologise for the delay in responding to you because of staff holidays.

I wish you well with your research. Jackie

Dr Jacqueline Watson

Chair EDU Ethics Committee

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Appendix 6 Student evaluation of PBL

Student satisfaction with PBL tutors and groups